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PRODUCT CULTURALIZATION

A Thesis

Presented to

The Faculty of the Department of Human Factors and Ergonomics

San José State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Serena M. Zhao

December 2004

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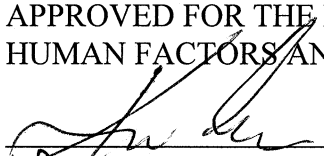
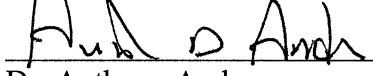
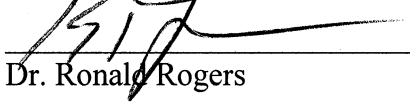


Dr. Kevin Corker



Dr. Anthony Andre



Dr. Ronald Rogers

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ABSTRACT

PRODUCT CULTURALIZATION

by Serena M. Zhao

There is a trend in the software industry to move towards culturalization, where the interface of the software is changed to be acceptable to each target audience. The purpose of this study is to determine how culturalization of products affects users' inclinations towards a product. A non-modified interface, which is found on basic handhelds today, and a culturally-modified interface, in which features were changed to accommodate a target audience from China, were presented to participants. This study found that there is a difference between a non-modified interface and a culturally-modified interface. Certain tasks were easier on the modified interface, and preference for the interfaces was split. This research was not enough to drive an investment in culturalization for companies. Interested companies would need to do further return on investment analyses to determine product feasibility.

DEDICATION

This thesis is dedicated to the family and friends who have supported me along the way.

ACKNOWLEDGEMENTS

I would like to thank Dr. Kevin Corker, Dr. Anthony Andre, and Dr. Ronald Rogers for putting up with endless questioning and an extremely aggressive schedule. I would also like to thank my parents, Eddy and Mary Gee, who have supported me through any endeavor. And finally to my husband, Tony Zhao, for believing in the "non-technical" side of things.

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INTRODUCTION

In recent years, companies have begun to realize the potential of non-English-speaking markets and thus software and web development has begun to edge towards "globalization" and "culturalization." This means that companies are taking more care to market and present their message in a user's native language. However, translation in itself is not enough. For a product to be fully globalized, meaning that it will be *able to support* localization into another language. For a product to be culturalized means that the product considers the subtle cultural differences and needs of the target market. This product must account for different cultural preferences, different aesthetic preferences, and subtle language differences.

> ...an interaction in our native language feels better, safer and more controllable than does a transaction in even a second language in which we feel comfortable. You have a far better chance of generating leads, engendering trust, and creating buyers if you adapt your value proposition to the ways of thinking and the market realities of your international prospects. (DePalma, 2002, p. 9)

IDC, a research firm, projects that by 2003, 36% of web users will prefer a language other than English for use with the web (Yunker, 2003, p. 10). In addition, web commerce is becoming less dependent on American sales. Globalization is taking a company's message to another market. Some firms "culturalize," taking local standards and cultural preferences into account, while other firms focus on translation of the product. Still other firms translate some parts, leaving some parts in English (APLAWS Research, 2002).

China is projected to be a large and fast-growing market, with over 1 billion people in residence (DePalma, 2002). Even so, companies need not look as far as China to find a reason for localizing for the Chinese community, as a large population of Chinese can be found outside China, and even within the U.S.

> With 50 million Chinese people living outside China and controlling most of the economic activity in many Southeast Asian countries such as Indonesia, Singapore, and, increasingly, in Canada and the Unites States, catering to the Sinitic economic community in diaspora could be great business for many companies. (DePalma, 2002, p. 13)

These numbers are based on market research by a large brokerage firm, and led to the creation of a website catering specifically to Chinese customers after the research discovered on average, Chinese people trade more than their American counterparts (DePalma, 2002).

Handhelds have been another recent-growing phenomenon. People increasingly use Personal Digital Assistants (PDAs) for schedule tracking, address storage and contact information, as well as, as portable entertainment devices. China has become the second largest market for handheld computers (Lawson, 2001). In 2001, Penbex, a Chinese handheld operating systems (OS) manufacturer, estimated that the market for PDAs in China was 2 million and expected it to grow 30% a year for the next five years (LeVander, 2002). Thus, the PDA market targeting a Chinese audience may prove to be lucrative.

Problem Statement

The purpose of this study was to determine how culturalization of products affects users' inclinations towards a product. It attempted to show users perform better on and prefer a culturalized product to a non-culturalized product. In this study, we analyzed the impact of proposed features based on observations and prior research of Chinese populations. We measured the performance and user preference for the following proposed features, based on their alignment with cultural differences shown by Chinese in mainland China:

- Linking of contacts as a way to store more information about a contact
- Integration of the lunar calendar
- Change to the address sequence input

Hypotheses

Culture appears to affect the acceptance of technology and this study aims to examine that. The null hypothesis for this study is that there will be no change in performance or preference on a culturally-sensitive device when compared to a baseline device. This research aimed to show the following alternatives:

- A specific culture group (Chinese from Mainland China) would show a statistically significant increase in performance for a culturally sensitive product (a modified PDA).
- A specific culture group (Chinese from Mainland China) would show a statistically significant increase in preference for a culturally sensitive product (a modified PDA).

Limitations

The study was limited to:

1. Chinese immigrants from China, drawn mostly from San José State University. Participants were so chosen so that they would represent the values of their native country while being within reach of the researcher by screening for people who were immigrants from the target country (S. Ehrlich, personal communication, November 19, 2002). However, this may have affected the generalizibility of this study since the differences the study would like to investigate need to be evaluated in the target population, with day-to-day workflows observed in the true setting. The impact of this limitation may be that the effect that this study examines can be somewhat muted.
2. People who are comfortable with the English language, since the experiment was conducted in English.
3. Fully naïve participants with regards to PDA interaction, as prior experience with PDAs may have an undesired practice effect.

Delimitations

The study was delimited to:

1. People under the age of 40, so as to diminish the effect from fear of new technologies or preference for "paper & pen planners." Although there is no correlation between age and computer anxiety, there is one between experience and computer anxiety (Loyd & Gressard, 1984; Howard & Smith, 1986; Glass & Knight, 1988, Necessary & Parish, 1996). PDAs are a relatively recent phenomenon, gaining mainstream usage

in the 1990s, so to guard against effects of computer anxiety from lack of exposure, the ages of the participants were screened.

2. People from Mainland China so as to create a more homogenous sample of the target population. Chinese populations from Hong Kong, Taiwan, Canada and America constitute separate populations with their own culture. "... (People) who describe themselves as 'Chinese' can be found in a host of cultures outside China. The political, social, and economic forces acting on these Chinese vary considerably" (Bond, 1992, p. 226).
3. This study did not look at cultures other than Chinese.
4. This study did not look at how translation affects technology acceptance. Instead, it is assumed that as language is such a big part of culture, it *will* affect technology acceptance. Thus the goal of this study was to show that there are *other* factors which must be considered. This study chose three modifications that will be discussed later.

Assumptions

Some of the assumptions made in this research were:

- Language is an important part of culture and *will* affect technology acceptance; this study does not need to show that it will.
- Currently, software culturalization has not had much progress. Software is modified from an original version minimally by translating the interface and/or supporting a few other date and number formats.

Definition of Terms

The following are terms that will be used throughout this paper.

Confusion. In this study, an expression of confusion was noted if the participant had behaviors such as "stroking chin with hand" and "deep frown," made noises such as "hmmmm," directly asked a question about what they were supposed to be doing, or otherwise stated that they were confused.

Culture. Culture plays a critical part in software perception and use. However, researchers do not readily agree on what culture is or a model of culture. Generally, culture is defined as the following:

- Culture defines members of a group as distinct from members of other groupings.
- Culture creates an orientation system and a field of action for these members.
- Culture manifests itself in cultural models. These may be internal cognitions or external artifacts and institutions.
- Cultural models may differ in their scope and therefore in their significance to a culture.
- Cultural models are acquired through interaction with the environment. Action and experience on the one hand and cultural models on the other affect one another through the processes of accommodation and assimilation.
- Culture does not determine the behavior of individuals but it does point to probable modes of perception, thought and action. Culture is therefore both a structure and a process. (Honold, 2000).

Geert Hofstede called culture the "software of the mind," the unconscious programming that we are subjected to from our environment (Hofstede, 1991).

Culturalization. This word is not yet in mainstream usage. This term was first heard as used by Lynn Shade, International Solutions Manager at Adobe Systems, Inc.

This is the process by which a product is made suitable for markets other than the home market, with particular attention being paid to the cultural undercurrents. "Localization" was intended for this process, but localization has come to mean "translation" to many.

Frustration. In this study, an expression of frustration was noted if the participant made "angry noises" such as "argh" and "grr," or otherwise stated that they were frustrated.

Globalization. Some companies use this as equivalent to "culturalization." However, this process is more similar to internationalization (see below). In this study, "globalization" and "internationalization" will be synonymous unless otherwise noted.

Hesitation. In this study, an expression of hesitation was note if the user hovered over a particular area for more than 30 seconds while looking at the screen with their hand on the computer mouse.

Internationalization. Internationalization is the process "of generalizing a product so that it can handle multiple languages and cultural conventions without the need for redesign. Internationalization takes place at the level of program design and document development" (Esselink, 2000, p 2). In other words, internationalization is designing a specific product so that it can handle all locales. For example, using Unicode (see below for a definition) to encode character sets will cover most of the character sets in use today for all languages, making the need to implement different character sets for different localized versions of applications unnecessary. Generally, internationalization occurs before localization as localization deals with the actual implementation of the product.

For the purposes of this study, we will assume that the product has been internationalized – it can reliably handle double-byte characters.

Localization. Localization is the process by which products are specifically detailed for a particular market. Localized products should be indistinguishable from products produced by a certain culture for members of that culture (Honold, 2000). However, localization in software today generally focuses on the technical aspects of the application, if anything at all. For example, developers will ensure that date formats, currency symbols, and articles specific to one culture are implemented and that basic user interface elements are translated. However, little attention may be given to the fact that entire categories of functionality are "wrong" for a particular culture and they need another type of functionality. For example, English text usually flows from left to right, starting from the top-left of the page, continuing to the bottom, which is the way most layout programs are designed. However, Japanese and Chinese text can flow top to bottom, starting from the top right of the page and continuing to the left, in addition to the "usual" left-to-right flow. Localized applications are not at all adequate for their intended audience, but often, users are willing to put up with low cultural awareness for computational functionality (Norman, 1988). For the purposes of this study, we will add some localized features and analyze how the participants react.

Perceived Difficulty. Perceived Difficulty will be a rating from the experimenter on a scale from 1-5, ranging from "Very difficult" to "Very easy" on what the

experimenter feels is the difficulty of the task for the participant. This will be compared with the participant's self reported ratings.

Performance. Performance is a measure of how well the user performs with a certain interface. In this study, "performance" will be a change in search times for information on the modified PDA interface.

Preference. Preference measures a user's attitude towards an interface and their acceptance of the interface. "Preference" will be measured by a Likert-type scale subjective rating given by users.

Unicode. A character set that assigns unique character codes to characters in a wide range of languages for use with computers. Unlike the American Standard Code for Information Interchange (ASCII), which defines 128 distinct characters, there are as many as 65,536 distinct Unicode characters that represent the unique characters used in many languages.

Importance of the Study

U.S. software plays an important role in the shaping of the way designers will look at the software to be marketed because the United States plays such an important role in the world software market. Despite claims that U.S. dominance will weaken because of competitive threats from abroad, the U.S. will remain in its dominant role for some time to come (Carmel, 1997). Carmel states that the U.S. has nine advantages that it benefits from: skilled labor that is not easily replicable, favorable capital conditions, sophisticated customers, close association with hardware vendors, a competitive

marketplace, geographic concentrations, first-mover advantage, a strong intellectual property regime, and English as the software lingua-franca.

While Carmel makes valid points about the dominance of American software, this dominance is not assured. Assuming that producing English-based products is enough for the software market is no longer feasible. With China's population at 1.6 billion and U.S. census figures reporting that the U.S. Spanish-speaking population outnumbers the entire population of Canada, doing business in more than one language becomes a concern (Turk, 2001). By 2005, 75% of online users will be from outside the U.S. (Turk, 2001). English-speaking countries only constitute 8% of the world's population (Marcus, 2001). The estimated growth of Web-based business in the Asian market alone is 15%-20% annually (Turk, 2001). American companies can no longer afford not to culturalize, especially when competitors are starting to culturalize products. Content in only one language is becoming unacceptable, especially since less than half of current Internet users claim English as their native language, as compared with a few years ago, when two-thirds of Internet users were native English speakers (Yunker, 2003, p. 10).

"America's overall market leadership [in packaged software] is not 'grunt work' that can be done at low cost, but is mostly design work" (Carmel, 1997, p. 125). I postulate that in order for America to maintain its leadership, the designs for localized products must take into account the cultural differences that separate different populations. Unfortunately, most of today's "localized" software only provides a translated version of an American software product designed with American users in

mind. In such a scenario, international users are forced to use "localized" features which were tacked on to a U.S.-oriented product with no consideration for other cultures. This can cause a "psychic bruising," in which the user suffers a culmination of negative emotional responses (Shade, 1999).

Culture can be also unconsciously embedded into the software components themselves by the design process, which is also subject to cultural influences (Kersten, G.E.; Kersten, M.A. & Rakowski, 2002). Hence, an American designer will design from his/her culture's point of view, which often results in a software package that is useful for the home market, but not anywhere else. In order to design internationally-correct software and to begin to truly culturalize, designers must recognize and account for cultural differences. "The recognition of culture as a primary concern in the design of the application core is a key factor in the successful deployment of applications targeted at the international market" (Kersten, et al., 2002, pg. 16).

Designers already recognize a need to design for users, hence the move towards user-centered design (Nielsen, 1993). Norman (1988) argues that the design of products should give clues to the user on how to use the product and to prevent mistakes, especially catastrophic mistakes. However, when considering usability for culturalized products, "usability must be re-defined in terms of a cultural context, as what is 'user-friendly' for one culture may be vastly different for another culture" (Barber & Badre, 1998, p. 11).

Although there are risks that may prevent entering new markets, such as the state of intellectual property and piracy laws, this study hopes to aid companies in making the choice to target other markets by providing extra information on the effort needed to make a product successful in the given market. This research can be seen as complementary to other risk analysis and market research.

REVIEW OF LITERATURE

Overview

This review of literature covers the gradual move of computer software towards culturalization, meaning that software is becoming more sensitive to the needs of non-English-speaking cultures. The review discusses what is happening currently as companies try to culturalize and what the different levels on the way to becoming truly culturalized are. The bottom line is that different cultures have different psychological associations and this leads to different interface needs. Studies in areas such as computer supported cooperative work show that there are methods to understanding those differences. The review then presents some design guidelines to consider when designing for intercultural usability. These have been used as guidelines for the cultural aspects of my study design. In addition, the review provides information on Chinese culture and PDAs in particular, as they are the subject of this study.

Move towards Globalization

The globalization and culturalization of the world's computer software is forcing users and producers to look at how software is developed for countries other than the source of the software. Most of the world's software is developed in the U.S., and then exported to other countries for consumption. However, this presents a problem as the culture of the originating country is usually embedded into the software, causing confusion and sometimes rejection of the software. Take e-mail emoticons (commonly known as "smilies"). Are you smiling [:-)] or are you smiling [(^_^)]? Are you happy

[:-))] or are you happy [(^o^)]? In this example, the first emoticons of both sets are American usages, while the latter are Japanese usages (Marcus, Armitage, Frank & Guttman, 1999). Something seemingly as trivial as expressing a smile or happiness using emoticons produces vastly different representations in two different cultures.

As not all cultures are the same, these subtle differences will cause items to be interpreted differently between cultures. "What becomes clear is that one medium [the Internet] does not equate with one interface. Instead, the interface design, interactivity, and content reflect a cultural sensitivity and understanding of the targeted audience" (Barber, et al., 1998, p. 1).

Hofstede defined five dimensions of culture in a study conducted during 1978-1983, spanning hundreds of IBM employees in 53 countries. Hofstede reasoned that by using employees of one company, IBM, he would avoid any differences due to differences in corporate culture, which is different from culture at a national level. His "Dimensions of Culture" are the following (Hofstede, 1997):

- Power-distance: the extent to which less powerful members expect and accept unequal power distribution within a culture.
- Collectivism vs. individualism: the extent to which people identify with a group for their primary identity.
- Femininity vs. masculinity: the extent to which a culture separates traditional gender roles. (In feminine cultures, the separation is less strictly enforced.)
- Uncertainty avoidance: the extent to which people are comfortable with new or uncertain matters.
- Long- vs. short-term orientation: the extent to which Confucian values, which emphasize patience, are integrated in life.

Based on these five Dimensions of Culture, Marcus (2000) conducted a study where he compared various websites and showed how various cultures would be reflected in the websites that they produced.

The user interface can no longer be considered just the set of strings that are translatable, which is the "traditional" engineering way of thinking about the user interface. Marcus (2001) determined that user interfaces have the following components:

- Metaphors: fundamental concepts communicated via words, images, sounds and tactile experiences.
- Mental Models: structures or organizations of data, functions, tasks, roles and people in groups at work or play.
- Navigation: movement through the mental models, i.e. through content and tools.
- Interaction: input/output techniques, including feedback.
- Appearance: visual, auditory and tactile characteristics.

Traditional localization processes have been geared towards the Appearance component iLanguage, 2002). However, as the list shows, the software industry has only begun to scratch the surface. "Creating or retrofitting web content for other cultures and languages requires a huge attention to detail, and translation is just the tip of the iceberg" (Accessible and Personalized Local Authority Web Sites (APLAWS) Research, 2002).

Some levels of culturalization extrapolated from iLanguage (2002) are listed below. iLanguage deals mainly with websites, but the levels of culturalization, which they call "globalization" can also be applied to software in general. (In this study, "globalization" is taken to mean the *ability to support* other markets, not the actual support.)

Table 1 (Adapted from iLanguage, 2002)

Culturalization Options

Level	Feature
English-centered Culturalization	• Main user interface components are in English • Foreign users are expected to manage in English • Company believes that English will remain the world's *lingua franca* • Among 90% of companies without culturalization strategy
Superficial Culturalization	• General content and operational information are in English • Advanced features are in English only • Some use of machine translation
Average Culturalization	• Product teams handle all aspects of product • User interface is in English and two or more other languages • Localized versions are tailored to each market • Some autonomy for foreign office team members • Some reprogramming involved • Reliance on freelancers and machine translations
Full-Scale Culturalization	• Multilingual products • Adaptable platform and templates • Decreased programming costs • General criteria for localized version, but localization is expected of each product • Localized version reflect knowledge of specific markets/customers • Coherent culturalization strategy • Localized versions released simultaneously with English version, or soon after • Cost-effective standardization • Service provided by experienced, reputable culturalization partner

According to the APLAWS research (2002), which lists recommendations for interface design for international web audiences, the basic requirements to consider for interface research are: languages, users and content. Designers need to understand what languages are spoken in the target region, what peoples make up that region, including minorities, and the content that is relevant to that particular region. In addition, web sites can have culturally shallow and deep interfaces. A culturally deep website will also pay attention to the text (direction of script), images, colors, fonts and navigation elements as opposed to culturally shallow sites, which focus mainly on translation (APLAWS Research, 2002). All of these elements are prone to possible error with respect to cultural assumption, so each must be researched before deploying to various regions. For example, icons may be perfectly recognizable in one culture but present a puzzling problem in another. Figure 1 illustrates this problem:

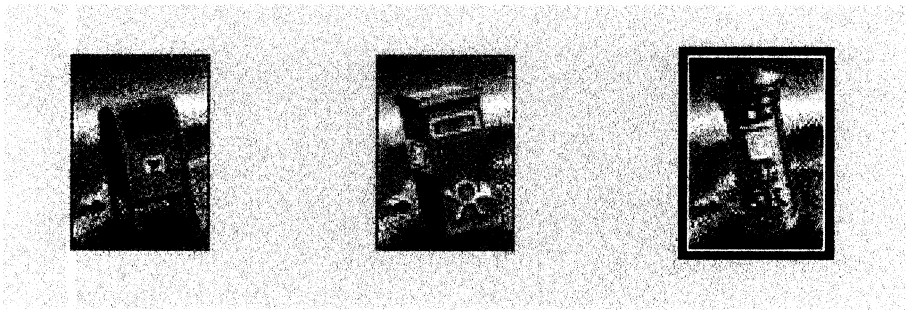

Figure 1. Different mailboxes from different cultures (Marcus et al., 1999)

As Figure 1 illustrates, mailboxes can come in different colors and shapes. Icons depicting a mailbox will confuse some users who are not part of the culture that uses that particular mailbox.

Different cultures have different psychological associations. When the user is presented with information the user is hypothesized to go through three consecutive stages: perception, semantic association and logical reasoning. Cultural dependence increases as the user progresses through each stage (Ito & Nakakoji, 1996). Take this scenario as an example of how culture colors perception:

> Bill Solomon is a senior executive of Top Quality, an American manufacturing firm, and has now just arrived in Tokyo for the first in a series of meetings with a new joint venture partner, Yamada Corporation of Japan. A number of Yamada executives are present and during his speech, Bill calls Hiroshi Sato, sitting at the far end near the door, to the front of the room. Sato has done an excellent job of paving the way for the Top Quality-Yamada joint venture. Sato does not wish to come forward, but Bill insists and presents Sato with a set of nicely wrapped set of engraved pens. Sato looks around nervously during the embarrassed silence. The Yamada people share nervous glances with one another. Sato bows several times and then retreats to his seat. The chairman then motions for the meeting to be adjourned for a few minutes. (Bergman, 2002)

In a strongly hierarchical and collectivist society, such as Japan, the individual is never singled out and rewarded. The group should have been recognized. The chairman, *in order to make sense of what he was seeing*, probably thought that Bill and Sato had some shady dealings occurring. Sato's career, which through hard work and perseverance would have followed a clearly defined path upwards with no shortcuts, was ended with a transfer to a remote location with no hope for revival, as changing companies is rare (Bergman, 2002). Even though people understand to some extent there is culture clash, people will still interpret the presented information within the lines of their mental processes, i.e. their culture.

Studies have shown that the use of cultural markers (interface design elements and features that are prevalent and preferred in a particular cultural group) and genres are evident in websites (Barber, et al., 1998; Badre, 2001; Dong, & Salvendy., 1999). In fact, many of the studies on culturalization were done on websites, mostly because web layout changes quickly and are often localized into different languages. Designers for the Web use culturally established processes to guide them in website design, be it consciously or unconsciously (Barber, et al., 1998).

Other studies (Sacher, Tng & Louden, 2001; Wang, Zhai & Su, 2001) have called for paradigm shifts in how users interact with the computer. The current method with a keyboard with roughly 102 keys with the Latin alphabet as the main input method is a result of computers being developed in the West. Language input methods faced the same problem – before, the computer was based on 8-bit ASCII encoding, which was enough to code for the 26 letters of the Latin alphabet plus various symbols. However, other languages posed a problem. For example, the Japanese syllabary has 100 characters, 50 each for their two syllabaries. However, they also use Kanji, often known as "Chinese characters." In Chinese, an ideographic language, there are 20,000 characters that are in daily use, which make up the bare minimum for proficiency, but there are at least 60,000 characters in use and new ones can be added, unlike the relatively static Roman alphabets (Lunde, 1999).

To get around this problem, Unicode was introduced in the hopes that one character set can be used for all languages on the computer. Character sets, or encodings,

illustrate the design process that we are now trying to avoid – the original input method was designed with no consideration for other languages/cultures and hence we are faced with multiple encoding systems that sprang up in an effort to code languages that are often not compatible, and the need to find another solution – Unicode. Accepting Unicode now often means reprogramming at least some parts of the product, but the benefits from being able to support it makes it worth the effort (Jastram, 2001). Most existing input methods put intermediate encoding layers on top of the English keyboard to enable input, but are not designed from the perspective of Asian users (Sacher et al., 2001). Lunde (1999) details some keyboards specifically designed with Chinese, Japanese, Korean, and Vietnamese (CJKV) users in mind.

Computer supported cooperative work (CSCW) studies deal with designing a collaborative workspace where several members can work together. Papers on this design process illustrate that culture is an important factor in technology design. CSCW is defined as "work by multiple active subjects sharing a common object and supported by information technology" (Heaton, 1999, p. 210). There are at least three major applications of CSCW, undertaken by teams in different countries. The main difference is that American CSCW studies have tended to take an empirical approach and focus on product developments and small-group applications. On the other hand, European studies are more theoretical and philosophical and tend to focus on user organizations and organization systems. In Japan, considerations are more pragmatic and there is more interest in formal workflows as well as more group-centered activity and transmitting the

subtle points of communication – personal space boundaries, bodily gestures, eye contact, etc. (Heaton, 1999).

Designing for Intercultural Usability

Another trend in the software industry is to involve the user more in the design process. Aside from user-centered design (Nielsen, 1993; Norman, 1988), recently there has been a shift to designing *with* users as opposed to *for* users (Sanders, 2002). This method is called participatory design, in which designers "design for experiencing" by "empathizing with users" to reveal latent needs by working with users to achieve their goals. Participatory design believes that all users know what they want; they just need help expressing their true desires (Sanders, 2002). In contrast, observed behavior, the focus of user-centered design, is just what people *want* designers to see and hear (Sanders, 2001). This may limit the amount and type of information that may be critical to product design. For example, if users know that designers are watching, they may do things differently in an effort not to appear unknowledgeable. However, this may cause designers to overlook flaws in the product that present hurdles to users, such as overly complex keyboard commands to invoke often-used functions. In user-centered design, there is also the concept that the user does not always know what he/she wants, so the designer must anticipate that (Nielsen, 1993). This attitude may lead to some designers believing that the user is not qualified to state what is needed and design decisions may be made based on what the designer, not the user, wants.

In designing products for international markets, more care needs to be used in the user studies since the same cultural influences that affect the product must also be considered in designing and conducting the user studies. Focus groups prove to be an integral part, being the method of choice in many studies (Beu, Honold & Yuan, 2000; Honold, 1999) because "...generally speaking there is no substitute for conducting interviews in situ" (Beu, et al., 2000). Focus groups gather representative users together to discuss user requirements. However, cultural constraints, such as reluctance to speak up in a group for Japanese participants (Honold, 2000) may need to be worked around.

Questionnaires and interviews are also used as a tool to gauge user input (Fukokoka, Kojima & Spyridakis, 1999; Honold, 1999; Honold, 2000). Such questionnaires must attempt not to contain any cultural bias from the conductor's culture. For example, Hofstede (1997) also admitted to omitting his fifth Dimension of Culture (Long- vs. short-term orientation) until other studies made him realize his flaw by conducting those studies from an Asian frame of mind.

Focus groups and questionnaires, however, do not collect actual behavior, only what people report about their behavior. Sometimes users are just not able to express what they need in questionnaires and interviews, and designers will receive vague comments such as "It just doesn't feel right."(Sacher, 2000). So traditional usability tests, where users are observed interacting with the product, are also employed (Fukokoka, et al., 1999; Honold, 1999; Marcus 2002). However, even with the complexities involved with international user studies, the insights gained from local interviews can have a great

impact on the design process. For example, Honold (2000) was able to derive a framework for determining the cultural influence in product usage during a study involving German clothes washers in India while interviewing the Indian users and noting their workflows.

Localization does not equal simply translation (Nagamachi, 2002). There are many aspects of culture that a developer needs to be aware of – ethnic stereotypes, religious symbols, gender roles, jargon, humor, text and graphics formats, colors and different locale languages all need to be addressed in a properly culturalized interface (Evers, 1997). Evers (1997) also found that preferences for the following matter for a culturalized interface:

- Colors
- Menus
- Input devices
- Sounds
- Multimedia

Users need to accept an interface for it to be considered successful, and user acceptance is based on their expectations. This study attempts to empirically demonstrate that cultural differences also play a role in technology acceptance.

Cultural Factors

Many studies have attempted to provide guidelines in designing for culturally acceptable interfaces.

Del Galdo (1990) identified the following as cultural factors:

- Character sets: Latin, Arabic, Hebrew, Kanji and Cyrillic script all have different systems that need different functionality and display features.

- Collating sequences: The Alphabetic and Alphanumeric lists are sorted in alphabetical order. Different cultures have different rules for sorting characters.
- Numeric formats
- Date formats
- Currency formats
- Time formats
- Telephone numbers
- Icons and symbols
- Colors
- Screen text: Use of abbreviations, acronyms or jargon
- Short cut keys and documentation

Russo (1993) & Boor identified the following as cultural factors:

- Text
- Number
- Date and Time
- Images and Symbols: Representations of people in icons is very culturally sensitive.
- Colors
- Flow: America-oriented interfaces have a left to right flow of information while Arabic users are used to working with a right to left flow.
- Functionality: Some functionality is not needed in certain cultures (e.g., change case function for Kanji).

Honold (2000) identified eight factors that need to be taken into account when defining the requirements in different cultures:

- Objectives of the users
- Characteristics of the users
- Environment
- Infrastructure
- Division of labor
- Organization of work
- Mental models based on previous experience
- Tools

And for each factor, designers need to ask the following questions:

- What objectives does the user hope to achieve with this product?

- What aspects of the topic being investigated qualify as relevant factors in the use of the product?
- How do these factors affect the way in which objectives are achieved? How do they interact?
- What effects does this have on the way in which the product is used?
- What are the concrete requirements in terms of product features that can be defined as a result?

"... (The) success of product internationalization is decided at the stage when the requirements are defined" (Honold, 2000, pg. 342).

Barber, et al. (1998) presented the Culturability Inspection Method that aids in evaluating the level of localization (shallow vs. deep) in websites and in the identification of cultural markers. In this method, there are three stages:

- Foraging: categorizing websites by country, genre, and language.
- Cultural marker identification: detailed inspection of categorized websites to identify recurring cultural markers – colors, themes etc.
- Pattern identification: cultural markers are checked for patterns within countries and across regions.

Another type of engineering based on internal user requirements is kansei engineering. Kansei is a Japanese word meaning "psychological feeling" and describes an integrated psychological concept of cognition and the five senses. Using kansei engineering, designers can translate the kansei into a new product design. Several successful products have been engineered with this method, including the Mazda Miata and Wacoal Good-up bra (Nagamachi, 2002). Kansei is a form of user participatory design, which tries to express the user's desires. Since it designs according to users' observed requirements, their culture is also accounted for, as "cultural factors seem to run deeply in mental processes" (Marcus, 2001, p. 504).

Analysis of Methods

Much of the information available about cultural impacts on design is company and product oriented. Pia Honold has published several articles on research conducted on projects from Siemens (detailed below). It may be that much of the research from companies most likely is proprietary information and not published.

The methods used for the papers cited in this review ranged from anecdotal accounts of personal experience to return on investment (ROI) calculations to experiments published in scientific journals.

Some sources (Honold, 1999, 2000; Shade, 1999) gave personal accounts based on market research for the author's respective companies. Some authors (Heaton, 1998; Kersten, 2001; Sacher, 2000; Shade, 1999; Sheridan, 2002) provided case studies of culturalized products and explained why they were or were not successful in the target markets or why they would not be successful in other markets.

There are also numerous papers that offer design guidelines with no scientific grounding cited. Some are based on market research that the authors have performed themselves, such as Beu, et al, (2000) and APLAWS Research (2002). Barber, et al (1998) cataloged hundreds of websites from around the world to identify cultural markers and themes, but did not mention how the sites were selected.

Some authors gave guidelines on how to conduct future studies. Beu, et al (2000) mentioned that development of appropriate Chinese questionnaires was new territory and listed some Chinese behaviors that may present barriers in a focus group-type setting.

They also gave some guidelines on how to lead Chinese discussion groups. Honold (2000) also gave guidelines for interviewing and further stated that interviews should be conducted in the participants' homes. Namagachi (2002) outlined the Kansei engineering process.

Other papers presented design guidelines specifically for dealing with culture. Marcus (2000) presented some guidelines based on Hofstede's dimensions of culture, but provided no basis as to why he feels that such guidelines are sound.

There have been some academic studies, meaning not related to any product or company research, done as well, such as the Evers (1997) study. Evers took her participants through the following exercises:

- Structured interview, in which Evers talked to the participants and asked them specific questions.
- Icon evaluation, in which Evers asked about different types on icons and participants' preference to each.
- Splash screen color-in, in which Evers asked participants to color in a splash screen.
- Screen layout task, in which Evers asked participants to rearrange the icons for Microsoft Word 6.0.

In addition, Smith (1981) presented his participants with a series of pictures with associated questions in order to determine different stereotypes, for example, which is the "natural" way to turn a knob to increase a level. Dong and Salvendy (1999) conducted a study in which they examined search tasks for differing menu layouts – horizontal or vertical. They recorded the average time to find the search item and total number of excessive searches (calculated by taking the total number of mouse clicks and subtracting the minimum number of mouse clicks) on a search, as well as collected subjective ratings

with a Likert-type scale questionnaire. Straub, Loch, Evaristo, Karahanna & Srite (2002) also presented participants with various scenarios, but asked their participants to what degree they agreed with the actions in the scenarios.

Hofstede's (1997) groundbreaking cultural study is often cited. However, he did assume that each country only had one dominant culture. Each country has its minority populations, which give rise to the problem of locales – a specific place or section in a country that has a different "culture." "Community languages are languages spoken by members of minority groups or communities within a majority language context" (APLAWS Research, 2002, p. 3). Thus, research methods are also prone to cultural assumptions.

Chinese Culture

Actual system design features are valid constructs to test in a practical laboratory setting where users' reactions to certain features can be observed (Evers, 1997). Evers (1997) uses five such constructs:

- Culturally specific design preferences – represents what the users want the system to look like and what functionality should be included.
- Belief about system usefulness – represents the degree to which a person believes that the system would enhance job performance.
- Perception about system ease of use – represents the degree to which a person believes the system to be free of physical or mental effort.
- Attitude of satisfaction in using – represents the degree to which a user's perceived needs and the need to perform specific tasks are met by a system
- Anticipated system use behavior – represents how users are likely to respond tin various ways to outputs and actions of the system.

The current study focuses on the first construct (culturally specific design preferences).

Based on cultural anthropology studies (Bond & Hwang, 1992; Forbes, 2001; Hall, 1976; Hofstede, 1997; Marcus, 2001; Meridian, 2003; Trompenaars, 1998, Yang, 1992), the following cultural variables and the generalization of cultural characteristics of Chinese are:

- Neither universalist or particularist, meaning that they do not believe in an absolute set of rules to be followed and that there is a "right" versus "wrong"(universalist) as opposed to a set of certain behaviors in one situation versus a different set in other situations (particularist).
- More communitarist meaning that they place the welfare of the group above the welfare of the individual. (Versus individualistic).
- More neutral, meaning that they are less apt to display their emotions openly (versus emotional).
- More diffuse, meaning that they require more background information, for example, a person's family status and hobbies, before talking business (versus specific). Also called relationship-task.
- More achievement-oriented, meaning that they credit a person based on his or her personal achievements (versus ascriptive, meaning credit is assigned based on a person's family or job status).
- More hierarchical, meaning that power relationships, such as parent-child, superior-employee, teacher student, make up the backbone of society (versus egalitarian, meaning that people believe everyone is equal).
- More long-term oriented, meaning they are willing to "give up jam today for more jam tomorrow" (versus short-term oriented).

Certain aspects of Chinese culture lend themselves to PDA redesign. In China, *guanxi*, or interpersonal relationships, is everything. Who you know can get you anywhere, from closing business deals to getting a doctor's appointment. It is an integral part of life (Dunfee & Warren, 2001). In addition, China uses both the Western and Lunar calendars on a daily basis. The Western calendar is the one most-used for business and keeping in sync with the rest of the world. However, the lunar calendar still plays a central role in Chinese lives. It is consulted for important events and to find auspicious

times, or times that would have a lucky influence on the task to be accomplished. For example, a business will seek for an auspicious date to have a grand opening, and a couple about to wed will consult the lunar calendar for an auspicious date to wed, and even an auspicious hour to conduct the ceremony. While the lunar calendar is no longer the "official" calendar, many people still consult its directions on when it is lucky to move into a new house, marry, get engaged, open a business, break ground, and other important life events ("Chinese Lucky Days," 2004). In addition, addresses are kept in a different fashion – namely in that Chinese addresses begin with the country and end with the person's name. Chinese people tend to write addresses from the largest unit down, whereas American standards are from the smallest unit up. For example, an American address starts with the name of the addressee, followed by the number of the house, the street, the city, the state, the zip code and sometimes the country. Chinese addresses (aside from having no zip code) are written in the exact opposite order, starting from the country, down to the recipient.

Table 2

Chinese Addresses vs. American Addresses

Chinese Addresses (usually written in Chinese, but for this example, written in English)	American Addresses
China, Canton ZhuHai, GongBei 10 Conifer Street B5, Flat 7	218 South Morrison Avenue San José, CA 95126 USA

This may be related to the concept of the self as the smallest unit and the group as the higher unit (communitarist) (Hofstede, 1997).

Personal Data Assistants

PDAs are handheld computing devices that are used to aid people in tracking their daily appointments, to-dos, contacts, and memos. These are considered the basic functions – most PDA devices have a separate button for each of the above functions. People can also add software and enhance the basic functionality to include playing games, reading e-books and managing projects.

As with many products, the PDA embodies the culture and the assumptions of its American creators. "Concepts like the PC or the PDA were primarily defined from the North American context – pretty much like playing baseball or eating hamburgers. Assumptions about Americans' behavior, values, and goals are encapsulated in the mental models represented by such products" (Sacher, H. et al, 2001, p. 42). For example, in contrast to expectation by the American manufacturers of PDAs, such as Palm, Inc. and Handspring, Chinese users tend to use their PDAs most often as an e-book reader, then as an electronic dictionary (Hi! PDA, 2003).

Based on a cognitive walkthrough of a PDA following the methods outlined in Polson, Lewis, Rieman & Wharton (1992), two functions of the current PDA are considered essential functions: 1) datebook, in which the user schedules meetings and 2) contacts, in which the user can store information about his various contacts, such as

name, telephone number and company name. These functions will be considered for redesign to support Chinese culture.

Conclusion

Based on the information in the literature, this study measured the impact of adding the following features to a "basic" PDA:

- Allow for linking in contacts, namely extra screens for making and viewing relationships, integrating the concept of *guanxi* because China tends to be a more diffuse culture (Bond et al, 1992; Honold, 2000; Meridian Resources Associates & Advanced Technologies Group, Inc., 2003). In the Contacts application, the user will be presented with an extra field called "link" that can be used to connect to another preexisting contact. The relationship is 2-way.
- Integration of the lunar calendar, based on Motorola research for the A388 phone, which was done based on recommendations from an employee based in Hong Kong (L. Shade, Manager of International Solutions, Adobe Systems, Inc., personal communication, November 13, 2002).
- Modification of the collating sequence for addresses from small – large to large – small in accordance with Chinese cultural standards (Del Galdo, 1990).

These modifications were introduced into a simulation prototype in support of this study.

There are not many scientific journals published on the subject of culturalization as of yet, which is why the literature review relies on a few key players that have published,

such as Pia Honold, Geert Hofstede, and Aaron Marcus. Most likely, as more companies begin to pay more attention to culturalization, there will be more data.

METHOD

This section will describe the methods used to test the hypothesis that product culturalization will induce a preference from the target market. The purpose of the study was to determine how culturalization of products affects users' inclinations towards a product. In this study, we looked at proposed features based on observations and prior research of Chinese populations. We measured the impact of the following features:

- Ability to store more information in contacts
- Integration of the lunar calendar
- Change of the address sequence input

The features are features that we deem to be important to the Chinese population based on the characteristics as reviewed in Chapter 2. In fact, local companies in China have entered into the handheld market displaying some of the features above as well as added functionality, such as an e-book reader, dictionary, etc. that they perceive to be attractive to the Chinese market. Some handheld models and their manufacturers are:

- P528SM - SurWin Technologies
- Xiao Chao Long 1100- Haier
- Yin Long 800 - TCL Computer
- EagleTec PDA - EagleTec
- FengXing 300 - Founder Computer
- Ego 700 - Instant-Dict
- Lucidity - Lucidity

Participants

Forty participants were recruited for this study. The population for the study was limited to immigrants from China as the study focused on localization for the Chinese market. This study had a range of participants that have been in the United States from 0

years to 10 or more years to counter the differences of participants staying various lengths of time in the host country (the country that produces the software) and this length of residency was used as an independent variable. It is reasonable to assume that the participants will adopt more of the culture of their host country as time passes. The breakdown of the groups was based on the Tong (1996) study. However, I inserted a gap between the group boundaries so as to clarify boundaries between groups. The residency-based groups were:

- 0-6 months
- 6 months-1 year
- 2-5 years
- 6-8 years
- 9 years or more

Each group had eight participants.

Participants should have identified with Chinese as their main culture or at least one of their cultures. This, along with other characteristics, was ascertained by the screening questionnaire reproduced in Appendix A. Written competency was not screened for, though spoken and reading skills were by the same questionnaire.

The Chinese population was gathered through a process by which participants referred other participants with suitable criteria to the study. Participants were disqualified if their group (based on length of residence in the United States) had already been filled. The initial participants were gathered through an ad placed at San José State University kiosks and bulletin boards that recruited for a study in usability as well as through an inquiry at the San José State University International House. Participation

was voluntary. The participant pool was fixed before the experiment began so as to reduce the chance of exposing more of the experiment's purpose. When a participant in the initial selection was unable to take part in the study, additional participants were found through the initial ad method and not through recommendations made by any of the current participants.

Participants may have been aware of the study's purpose, since the consent form that the participants signed does discuss the purpose of the experiment. However, no attempt was made to certify that the participants were aware of the experiment's purpose. This understanding may have affected the results if they tried to answer in a way designed to either align with the study's expected results or skew the results in an opposite fashion.

In addition, participants were selected to be under the age of 40. There are some arguments that technophobia increases with age, but this is not so and technophobia is more correlated with confidence and experience. Studies (Loyd & Gressard, 1984; Howard & Smith, 1986; Glass & Knight, 1988, Necessary & Parish, 1996) support the theory that increased computer experience leads to decreased computer anxiety. Still, as computing for the average user is a relatively recent phenomenon, the age of the participants was restricted to screen for these effects.

The participants were also selected to be fully naïve to PDA interaction, so some training was required to bring all participants to a level in which they felt comfortable interacting with the apparatus described below.

While this study is not focusing on gender as a factor, some effort was made during screening to keep the number of males and females balanced.

The number of participants for this study relies on pragmatics and a standard assumption of variance. Since this was an exploratory study, calculating power would have been a difficult task as there is no standard of variance and no pre-defined measure for the cutoff point. The study proceeded with the proposed sample size due to lack of other supporting calculations.

Apparatus

The apparati used in this study were:

- Two simulated PDA interfaces on a laptop computer
- Interview Protocol, as reproduced in Appendix F
- Likert-type scale surveys to measure subjective ratings of the interfaces, which can be found in the appendices

The two simulated PDA interfaces used in this study were based on Palm OS 4.1, which showed a main screen for display as well as simulated menus and soft keyboard. The interface was presented to the user on the laptop monitor which comes with a Dell Latitude CPX (750 MHz, 256 RAM) laptop. The mockup was created with Hypertext Markup Language (HTML) on a Windows IIS web server. Data logging for click times and pages requested was captured with server-side scripts.

The user interacted with the apparatus while seated in front of the computer monitor and provided input using a regular two-button mouse. Due to technological limitations, these devices did not accept stroke input or the Graffiti writing that is associated with Palm PDAs.

The non-modified PDA interface attempted to represent the functionality and look-and-feel of the current Palm OS 4.1 faithfully, while the modified Palm had the additions mentioned above. Both interfaces looked like a regular Sony Clie TJ-615 PDA, but this was just a shell. The internal workings of the system were based on HTML and server-side scripts.

Screenshots of the PDA mockups can be found in Appendix J. The lunar calendar was presented in Chinese, though every effort was made to have the interface in English since the language of the interface was not studied here. However, a design choice was made to preserve the utility of the lunar calendar for Chinese users. Hence, at the risk of introducing more bias, the lunar calendar integration was done in Chinese. An elaboration of this can be found in the Discussion section.

In addition, an interview protocol was used for a structured interview in which the experimenter sat with each participant and asked questions about certain aspects of the modified PDA after the participant was done interacting with each interface simulation. The interview portion lasted for about half an hour for each participant, and contained questions about the user's overall impressions of the interface, for example, his/her feelings about the proposed functionality. In addition, questions were asked about his/her perceived usefulness of the interface, for example, by asking how much they would be willing to pay for the features they were shown. The interview also had questions concerning features that the participants feel necessary for a PDA.

Some of the questions on the interview contained a Likert-type scale rating, with values ranging from 1-5, representing "Strongly disagree" to "Strongly agree," that measured their subjective ratings on their perceptions of the PDA interface, their preferences – technology and screen layout, features that the user would like, and what the workflows the user has. The complete survey may be found in Appendix H

Due to the study's unusual cultural context, established surveys and interview procedures were not used or borrowed from, but did serve as a springboard for this study's instruments. Although leveraging work that has come before would increase reliability and validity of this study, the methods and instruments of this field of research are still in the development phase and can be refined through further research.

Procedures

Participants were met in a room containing the apparatus for a one-on-one observation with the experimenter. Before the experiment started, they were given a consent form (see Appendix B) and were asked to sign it, written instructions on what they were expected to do (Appendix C), and the sequence of actions that they needed to perform (Appendices D-1 – D-4). The tasks that the participants were asked to perform fell into three main categories: address entry, contact retrieval and date search. The participants were presented with both Chinese and American style addresses on both interfaces. The sequence of actions was counterbalanced along with the presentation of the interfaces since presentation order may be a cause of bias. Please see Appendix G for the presentation matrix.

The experimenter then asked the participant some pre-study questions and explained the concept briefly. The experimenter then asked the participants to go through a training exercise before each PDA interface (Appendix E-1 and Appendix E-2) to familiarize the participant with the major workings of the simulated interface. The experiment was then conducted by having the user go through a series of tasks presented in English on both the tailored PDA and then the unmodified PDA. The presentation of the PDAs was counterbalanced to remove the effects of order of presentation. The interfaces were always referred to as "interface A" and "interface B" so as to give the participants an easy way to refer to a particular interface, but they would not know which one was which at the onset of the experiment. After interacting with each PDA, the participant was asked to fill out a post interaction survey for that particular interface (Appendix H-1 for the non-modified interface survey and Appendix H-2 for the modified interface survey). After interacting with both interfaces, the participant was then asked to fill out a comparative survey on both interfaces. (Appendix H-3)

The experimenter also noted any difficulties that the participant had, such as hesitation, frustration, confusion or perceived difficulty in using the prototype, by using a data log to code data, as shown in Appendix I. This was followed by a run with the other PDA with the same series of tasks. This was followed by a short debrief for the participant and post-study questions. Most questions to the participant were on a five-point scale using the Likert-type scale. The remaining questions were for the purpose of

gathering subjective user data only. Detailed steps can be found in Appendix F, the test guide, which was carried to the experiment site by the experimenter.

For the sake of pragmatics, the experimenter conducted the entire session and sat with the user through it. Experimenter bias may have played a role in scoring of the results, but given the schedule of this experiment, this could not be avoided. The experimenter sat behind the participant, off to the side, so as to gain a better view, as well as to not bias the participant with experimenter expressions.

The experiment lasted roughly one and a half hours for each participant. The complete test guide can be found in Appendix F. None of the procedure was video taped or digitally recorded due to resource constraints. The experimenter collected data points in real-time.

Resources and funding were provided in part by Adobe Systems, Inc. Adobe Systems, Inc. generously funds graduate schooling for its employees. The remaining parts of this study were self-funded.

Design

This study was a within-subjects design with a comparison of performance and preference between a tailored PDA and a non-tailored PDA. Each subject was asked to perform a set of tasks (as detailed in Appendix D) on both interfaces. The interfaces were presented in a counterbalanced fashion. A subjective assessment was made by the experimenter of the difficulty of the tasks on each PDA based on the participant's

comments. There were a total of eighty trials consisting of forty participants using the two types of PDAs.

The design of this experiment is a nested, repeated measures 5 x 3 x 2 mixed design. The levels of the first factor are groupings based on lengths of time in the United States – 1) 0-6 months, 2) 6.1 months- 1 year, 3) 2 years-5 years, 4) 6 years-8 years, and 5) 9+ years. The levels of the second factor are changes in interface – 1) addition of a contact linker, 2) reversal of the address input sequence, and 3) the addition of the lunar calendar. The levels of the third factor are modification – modified and unmodified PDA interface. The major dependent variables are:

- time to task completion: The time to task completion is the time the user will take to retrieve a piece of information. Timings were taken for each segment of a task – input, distracter, and retrieval.
- subjective ratings: Subjective ratings are ratings that the user gives on overall impressions, value, etc. of the proposed features. For the complete survey, please see Appendix H. Even though ratings are subjective, they give insight into what a user feels about a particular subject. If the user feels that they do prefer that a function is present and this preference is consistent across subjects, then the study will assume that this feature is culturally significant. The ratings will be on a scale of 1-5, ranging from "Strongly disagree" to "Strongly Agree," respectively.
- use of added functions: Use of added functions are frequency counts of usage for the added functions.

Each of these measures was then tabulated as to the number of times they occurred and the frequency was analyzed to provide data on whether or not performance and preference increased with the modified PDA interface.

RESULTS

To measure the impact of the modifications to the standard PDA, the results of each trial was analyzed. The test was a full factorial ANOVA with repeated measures to analyze the main effects of culture on user performance. Frequency plots were used for user self-rated data regarding preference of one interface over another. Further post hoc analyses were performed in order to determine if the there would be differences among the five tasks. Alpha for all ANOVAs and post hoc tests was set at 0.05.

Performance Data

Users were asked to perform certain tasks on the two variations of interface and their performance times were recorded. There were three tasks involving entering an American address, two tasks entering Chinese addresses, three search tasks and two date tasks. The timings for each type of task were collapsed and the mean was analyzed.

Originally, this study was conceived as a Group(5) x Interface Changes(3) x Design(2) mixed design with the following levels:

- Group (Length of time in the United States): 0-6 months, 6.1 months-1 year, 2 years-5 years, 6 years-8 years, 9+ years
- Interface Changes: addition of a contact linker, reversal of the address input sequence, addition of the lunar calendar.
- Design: Non-Modified, Modified

Below is the performance data for different tasks sorted by groups.

Table 3

Mean Performance Data for the Non-Modified Interface by Group and Task

Group	Non-Modified Interface			
	American Address Entry	**Chinese Address Entry**	**Search Task**	**Date Task**
1	51.13	84.25	95.25	15.25
2	59.21	88.88	80.50	14.56
3	55.17	80.00	82.50	15.75
4	55.21	88.94	79.88	13.69
5	54.88	94.25	74.08	13.63

Table 4

Mean Aggregate Performance Data for the Modified Interface by Group and Task

Group	Modified Interface			
	American Address Entry	**Chinese Address Entry**	**Search Task**	**Date Task**
1	121.75	124.88	81.33	13.88
2	138.96	132.06	68.42	14.13
3	130.46	118.88	70.25	14.00
4	130.46	132.25	68.17	12.38
5	129.83	139.75	63.08	12.81

The original ANOVA for performance revealed an overall significance, $F(39, 320) = 65.41$, $p = .00$. However no main effect was found for group, or length of time in the United States, $F(4, 320) = 0.53$, $p=0.72$. Based on this, groups were collapsed for the remainder of the analysis of performance data, save for the date task, which was excluded from the final ANOVA analysis.

The date search was excluded from the ANOVA since it only served to increase the variance. This experiment did not record how people actually chose the date, and the tasks were not comparable on both interfaces. The participant may have used the lunar

calendar on the modified interface or may have just randomly have chosen a date because they were expected to. Therefore, the date search was analyzed separately.

Further preliminary analysis of the data was done to see what further analyses were justified. These preliminary analysis tests were:

- t-tests to determine what areas were significant
- a one-way ANOVA to determine if there were differences between business and social address entry
- a one-way ANOVA to test for order effects of interface presentation

T-tests for address entry ($t(80) = .00$ (one-tailed), $d = 78$), contact retrieval ($t(80) = .00$ (one-tailed), $d = 78$) and date searches ($t(80) = .00$ (one-tailed), $d = 78$) showed statistical significance. In addition, a one-way ANOVA showed no fundamental difference between entering an address for a business contact versus a social contact, $F(1, 160) = 2.85$, $p = .09$, so American address entry and Chinese address entry were aggregated into two respective groups. The addresses follow the same form in those cases. However, it was postulated that there may be a difference in how contact retrieval is done because people may tend to link business contacts differently than social contacts so the business/social distinction was left in tact for the contact retrieval.

The linking was also excluded from the ANOVA since there was no way to perform that function on the non-modified interface.

A one-way ANOVA was performed to test for order effects, which may have resulted if the participant learned from the first interface to the next, regardless of what interface was presented first. However, there were no significant order effects ($F(1, 400) = .63$, $p = .43$).

The main analysis ANOVA performed was a Design(2) x Task(5) ANOVA with the following levels:

- Design: Non-Modified, Modified
- Task: American Address, Chinese Address, Contact Retrieval-Business, Contact Retrieval-Social; Contact Retrieval-Bus/Soc

Due to an error in the presentation of two of the test scripts, leading to six of the Chinese addresses having the "American" order of addresses, some data points were excluded from the overall analysis. The ANOVA was performed with the mean scores of each task category, so the exclusion of several data points (thirty total out of 1200) did not affect the overall analysis in any significant way. The experimenter performed analyses under both conditions (with and without the erroneous data points) and the exclusion of the erroneous data points had no effect on statistical significance. The mean performance data for the non-modified and modified interfaces are listed in Table 5.

Table 5

Mean Performance Data for Interface by Task

	Non-Modified Interface (sec)		**Modified Interface (sec)**	
Task	**Mean**	**SD**	**Mean**	**SD**
American Address Entry	55.12	9.88	80.60	14.86
Chinese Address Entry	87.26	11.74	79.91	17.59
Business Contact Retrieval	81.63	15.49	16.90	14.57
Social Contact Retrieval	77.93	14.67	19.88	12.83
Business/Social Contact Retrieval	87.78	16.42	16.25	12.41

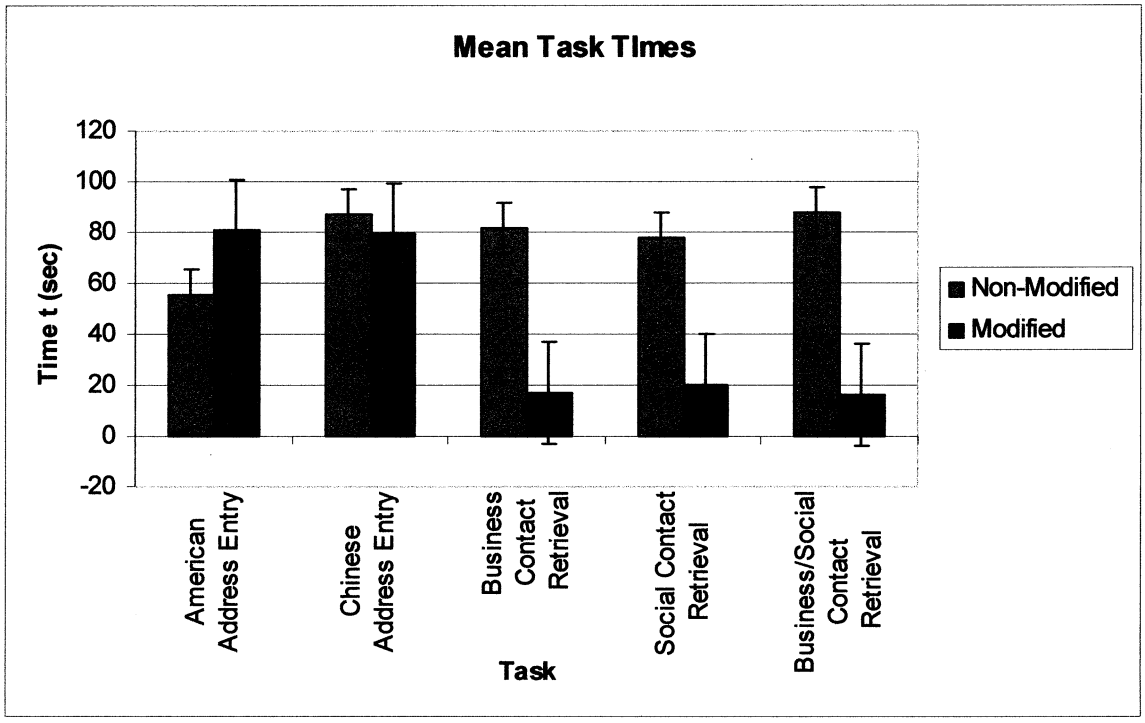

Figure 2. Mean Task Times

The corrected ANOVA for performance revealed an overall significance ($F(9, 400) = 114.15$, $p = .00$). Main effects were found for interface ($F(1, 400) = 394.12$, $p = .00$) and task ($F(4, 400) = 54.51$, $p = .00$). There was significant interaction between interface and task ($F(4, 400) = 110.34$, $p = .00$).

From Figure 2, we see that the address entry times were above 50 seconds on both interfaces while the contact retrieval times cluster around 80 seconds on the non-modified interface, then drop to around 20 seconds on the modified interface. Thus, the data suggests that there is indeed a difference between the culturally modified interface and the default interface. In addition, there is a difference in the types of tasks performed. Also,

given a task x interface interaction, the interface mode affects the performance on different tasks. The interaction is clear from Figure 3.

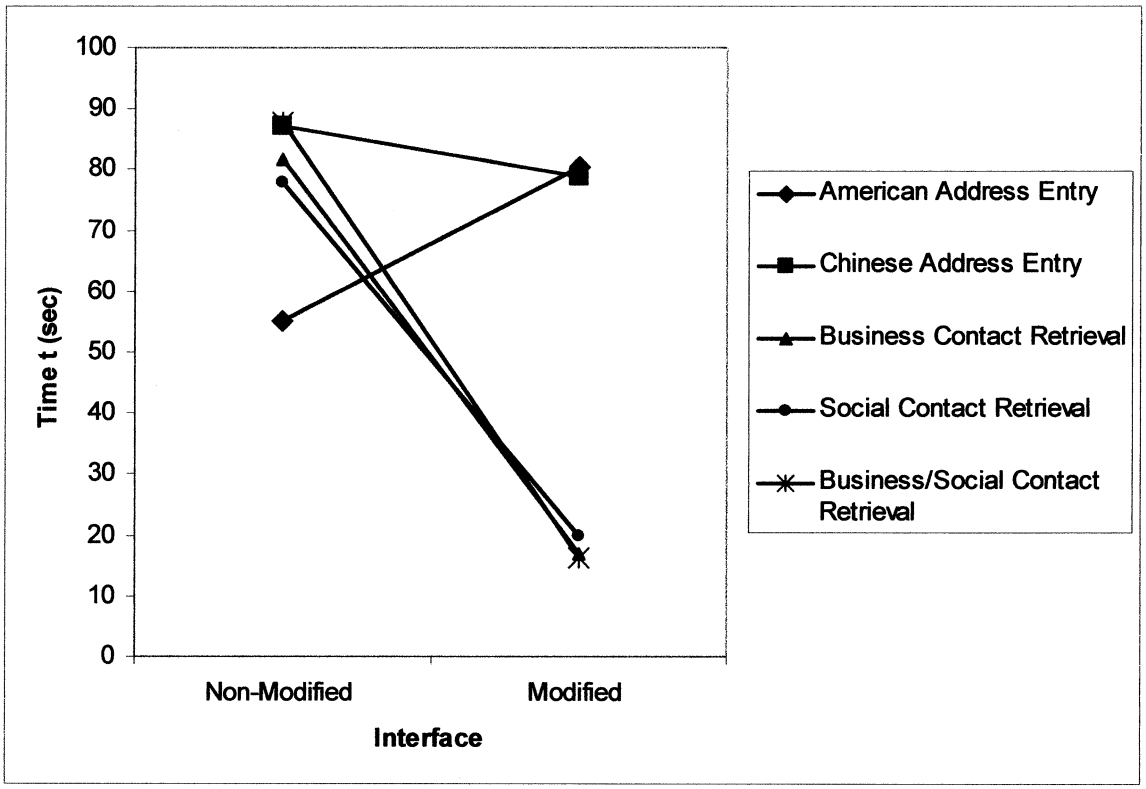

Figure 3. Interaction of Task and Interface over Time

A post hoc one-way ANOVA showed that the two address entry tasks were significantly different from the contact retrieval tasks on the modified interface ($F(1, 400) = 438.67$, $p = .00$). The post hoc analysis revealed that the difference for the tasks on the interface, were mainly due to the different classes of tasks – address entry and contact retrieval.

The behavioral data for frustration, hesitation and confusion were examined, and no differences were noted. (Actual data is presented in Appendix K.) Some users

reported that some aspects of the interface were confusing. This is discussed in the subjective survey data section following this section.

While the participants were asked to choose a date for a major life event to check if they used the lunar calendar, the researcher could not conclude how participants chose their dates for the date search task. Therefore, a frequency count of how many "correct" auspicious dates was chosen by group. A "correct" date was one in which the user was looking for a date to get married or open a business and selected a date that the lunar calendar indicated was auspicious for that event.

Table 6

Frequency Counts of Correct Auspicious Dates by Group

	# correct dates - social	# correct dates - business
Group 1: 0-0.5 years	8/8	6/8
Group 2: 0.6 - 1 years	6/8	5/8
Group 3: 2 -5 years	4/8	4/8
Group 4: 6-8 years	3/8	2/8
Group 5: 9+ Years	3/8	2/8
All groups	**24/40**	**19/40**

Group one chose the most correct auspicious dates (33% of all social dates chosen and 26% of business dates chosen), while group five had the least (13% of social dates chosen and 11% of business dates chosen). While there is a trend over the length of time spent in the United States (the longer in the United States, the less use of the lunar calendar), the numbers for the groups two through four have similar enough numbers that a statistically analyzed trend is not supported. In addition, it is of note that social dates

appear to be more relevant to the lunar calendar since all groups had more correct social dates than business dates. Further research may wish to look into this.

Participant linking behavior was also noted. The experimenter noted if the participant actually used the linking mechanism. One use was noted if the participant used the linker at any time during one address entry. All access points during a single address entry only counted as one use. There were eight possible links to be made for each address entry for each participant and a total of 320 possible links for each task for all participants.

Table 7

Frequency Counts of Linking Activity

	# links	Mean # links	SD	Total # links/ participant
American Business Address Entry	201	5.03	2.02	8
Chinese Business Address Entry	187	4.68	0.95	8
American Social Address Entry	145	3.63	2.01	8
American Business/Social Address Entry	121	3.03	2.12	8
Chinese Business/Social Address Entry	110	2.75	1.24	8
Totals	**764**	**19.10**	**8.34**	**40**

In rank order, the most links were made for business address entry, followed by social address entry, then social/business entry.

Subjective Survey Data

Users were also asked to fill out questionnaires using a Likert-type scale with a range from 1 to 5 (1 representing the least amount of preference and 5 the highest) to

record their subjective preference ratings of the two interfaces, separately, right after interaction with each interface. After interacting with both interfaces, users were asked to provide a subjective rating of which interface they preferred.

The surveys contained some questions that were opposites to test for consistency. For example, the users were asked if they felt information input was comfortable on one interface, then a few questions later, asked if they felt that information input was awkward. The questions had to do mainly with how comfortable information input and retrieval were as well as which interface was preferred. The data is presented below:

Table 8

Frequency Counts for Consistency Questions

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	SD
Non-Modified Information Input Comfortable	5	4	5	22	4	7.842
Non-Modified Information Input Awkward	21	9	3	3	4	7.681
Non-Modified Information Retrieval Comfortable	8	13	6	12	1	4.848
Non-Modified Information Retrieval Awkward	7	11	4	12	6	3.391
Modified Information Input Comfortable	0	1	9	26	4	10.654
Modified Information Input Awkward	15	14	6	5	0	6.364
Modified Information Retrieval Comfortable	1	9	10	16	4	5.788
Modified	4	23	10	3	0	9.138

Information Retrieval Awkward						
Interface Preferred Non-modified	6	10	10	8	6	2.000
Interface Preferred Modified	9	7	5	13	6	3.162

From the standard deviations from each of the questions presented in the last column of Table 6, there is approximately equal variability for each of the question pairs. Thus, the answers for the question pairs are consistent. The consistency of the above questions documents the reliability of the preference data from the participant surveys, presented below.

Table 9

Mean Overall Impressions

	Non-Modified Interface	Modified Interface
User felt that the interface was useful	3.175	3.450
User felt that the interface was user-centered	2.925	3.525
User felt that information input was comfortable on the interface	3.400	3.825
User felt that information retrieval was comfortable on the interface	2.625	3.325

For the overall impressions, a rating of 1 meant "Strongly Disagree" and a rating of 5 meant "Strongly Agree." For the non-modified interface, the reaction was neutral while for the modified interface, the overall impressions are slightly more favorable. However, the data is not conclusive here. Since the participants knew the general

purpose of the study, they may have put more favorable marks to the interface that they deemed to be the "different" one.

Table 10

Mean Task Impressions

	Non-Modified Interface		Modified Interface	
	Mean	**SD**	**Mean**	**SD**
Level of difficulty of finding a social date	2.90	1.65	4.53	0.57
Level of difficulty of finding a business date	3.10	1.63	4.60	0.59
Level of difficulty of entering and retrieving social contacts	2.50	1.13	3.55	1.07
Level of difficulty of entering and retrieving business contacts	2.33	1.17	3.25	1.08
Level of difficulty of entering and retrieving business/social contacts	2.45	1.13	3.35	1.03

For the task impressions, a rating of 1 meant "Very Difficult" while a rating of 5 meant "Very Easy." For the non-modified interface, the level of difficulty of finding a date was neutral, but participants felt that entering and retrieving information was difficult, especially for business contacts. This may indicate that users are more apt to need something to remember relations between business contacts. On the modified interface, finding a date became "very easy." Though the level of difficulty in entering and retrieving contact information improved on the modified interface, this experiment cannot conclude that it was "easy" to enter and retrieve information on the modified interface. More work needs to be done to improve the interface for target audience acceptance.

Table 11

Frequency of Self-Reported Confusion

	Non-Modified Interface	Modified Interface
User reported that the interface was confusing	2	19

Participants were asked if they felt the interface was confusing. Many more participants felt that the modified interface was more confusing than the non-modified. For the two participants who felt that the non-modified interface was confusing, the comments were about the limitations of representing a handheld device with HTML. The most frequent comments from the questions on what was confusing on the modified interface were about the lunar calendar and the address format. Participants mainly asked about why the address format was "backwards" on the modified interface. Though some of the participants understood why the input direction was state first, most of these participants felt that the American address entry was more comfortable, especially for addresses written in English, even if they were addresses in China. Other participants were not aware of the address distinction at all and just felt that the address entry was strange. This may account for the relatively long address entry times.

The other main complaint was about the lunar calendar – some participants were not sure what it was used for so they felt that it took up too much screen space. Given that screen real estate on a handheld device is important, this is an important factor to consider for handheld interface makers. Users should be given a chance to hide elements

that they do not wish to see. While the calendar could be hidden, most participants did not figure out how to hide it.

Participants were also asked for two features that they liked the most about both interfaces as well as two features that they liked the least.

Table 12

Frequency Count of Most-Preferred Features

	Non-Modified Interface	Modified Interface
Ability to store contact information	27	2
Ability to store schedule information	28	9
Ability to edit entries	6	2
Ability to refer to a lunar calendar	N/A	26
Ability to link contacts	N/A	35
Other	19	6

On the non-modified interface, most of the participants listed the main functions of a planner to be the most-preferred feature. This supports the cognitive walkthrough that was done before the experiment to choose what areas to focus on. The ability to edit entries was also important to some participants. They compared a digital planner to a paper one and felt that editable entries would enable them to keep their planner neat. There were also other most-preferred features, including the similarity to familiar paper-and-pen planners and being straightforward. For the modified interface, the participants were mainly attracted to the changes in the interface. The lunar calendar and the ability to link contacts were the most frequently most-preferred features. The features that were important on the non-modified interface dropped into a secondary position. The other

most-preferred features included comments on appearance and comparisons with the paper-and-pen planner. In the above table an entry of "N/A" denotes a feature that was present in one interface, but not the other.

Table 13

Frequency Count of Least-Preferred Features

	Non-Modified Interface	Modified Interface
Appearance	18	3
Physical limitations	7	0
Screen real estate issues	10	9
No other calendar references	4	N/A
Difficulty searching for groups	20	0
Address order	0	20
Interface not localized	2	5
Linking confusing	N/A	31
Inability to search for dates	N/A	5
Other	19	7

On the non-modified interface, most of the complaints were on the difficulty of searching for groups of people and on the appearance. Many participants felt that the interface was sparse without much color or pictures. The complaints in the "other" category included comments on how the mockup did not have enough features, not being able to cross out things on the planner as users can do on a paper planner and that writing is faster than typing for planners. In addition, some users felt that the interface was limited since users could not customize either the appearance or contact information. The major "screen real estate" issue for the non-modified interface was that the contact entry had a place to enter a picture for a contact, but it took up too much room and required the user to scroll to finish entering an address. This feature was more annoying where there were no pictures to enter.

On the modified interface, the major complaints were on the address entry order and the linking. Many of the participants felt that the address order was not suitable for English entry. In addition, the linking mechanism provoked many comments. Since this was a section under test, user feedback in this area is good. Most of the comments were about how the linker was crowded when there were too many links, that some of the elements in the linking interface were unclear and that there was no way to tell what type of link was created – if the link was to a peer, a superior or a direct report. These two items corroborate with the items in the participants' self-reports on confusing aspects of the interface as well. The "screen real estate" issues for the modified interface centered around the lunar calendar being too prominent and taking up too much space on the calendar view. An interesting note for the modified interface was that the users who used the lunar calendar wanted a way to search for a certain type of auspicious date. In other words, it was not enough that each date listed what activities were auspicious for that day. Users wanted the calendar to tell them which date was auspicious for a particular event. Also, some users did want the entire interface to be localized, complete with Chinese input. However, that was not the focus of this research.

Table 14

Frequency of Participants' Understanding of Linking Mechanism

	# of Participants
Illustrates a relationship	34
Makes groups	5
Did not understand	1

Participants were asked what they thought the linking mechanism on the modified interface did. From the above table, most people (34/40) did understand what the linking was for. Five people thought that the linking was to make groups, which was actually a byproduct of linking. Only one person just did not know what the linking was for.

After interacting with both interfaces and completing two individual impression surveys, participants were also asked to fill out a comparative survey which asked questions on the interfaces in relation to one another.

Table 15

Frequency Counts and Mean Comparative Overall Impressions

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean Rating	SD
User preferred modified interface	9	7	5	13	6	3.00	1.43
User felt the extra functionality of modified interface was useful	5	2	11	16	6	3.40	1.19
User felt that the modified interface met needs more	10	3	5	12	10	3.23	1.54

User felt that the modified interface was more user centered	7	5	5	8	15	3.48	1.53
User felt modified interface was a significant improvement on the non-modified interface	11	5	6	11	7	2.95	1.47

For the overall comparative impressions, a rating of 1 meant "Strongly Disagree" while a rating of 5 meant "Strongly Agree." Participants were generally neutral to how the modified interface fared. Some participants preferred the modified interface, but others preferred the non-modified. This may be because the feature set chosen was an "all or nothing" set. If users liked it, they liked it; if not, then they did not, hence the overall neutral ratings.

Table 16

Frequency Counts and Mean Comparative Task Impressions

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**Mean Rating**	**SD**
User felt that finding a social date on the modified interface was easier	5	7	7	9	12	3.400	1.41
User felt that finding a business date on the modified interface was easier	7	8	7	8	10	3.150	1.46

User felt that entering and retrieving social contact information on the modified interface was easier	3	9	10	11	7	3.250	1.21
User felt that entering and retrieving business contact information on the modified interface was easier	7	6	12	9	6	3.025	1.31
User felt that entering and retrieving business/social contact information on the modified interface was easier	6	8	9	9	8	3.125	1.36

For the overall comparative impressions, a rating of 1 meant "Strongly Disagree" while a rating of 5 meant "Strongly Agree." Participants were generally neutral on if they felt the tasks were easier on the modified interface or not. Again, the users were split. Some users felt that tasks on the modified interface were easier, others felt they were not.

Table 17

Frequency Counts and Mean Comparative Workflow Ratings

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**Mean Rating**	**SD**
User enters addresses beginning with the country	26	8	5	1	0	1.525	0.82

User enters address beginning with a house number	0	0	0	2	38	4.950	0.22
User consults a lunar calendar when planning major personal events	7	8	5	9	11	3.225	1.49
User consults a lunar calendar when planning major business events	8	7	8	9	8	3.050	1.43
User would record information on how contacts are related	1	10	8	12	9	3.450	1.76

For the overall comparative impressions, a rating of 1 meant "Strongly Disagree" while a rating of 5 meant "Strongly Agree." The major point on the workflow ratings is that users are much more comfortable entering addresses with the house number first. The opinion on use of the lunar calendar is split, with about half of the participants using it and half not. However, it appears that many of the participants would record information on contact relationships.

Table 18

Frequency Counts and Mean Comparative Feature Values

	Low Value	Somewhat Low	Neutral	Somewhat High	High Value	Mean Rating	SD
Linker	3	7	11	13	6	3.300	1.16
Lunar calendar	9	6	5	10	10	3.150	1.53
Addresses starting from country	40	0	0	0	0	1.000	0

For the overall comparative impressions, a rating of 1 meant "Low Value" while a rating of 5 meant "High Value." The value ratings for the linker and the lunar calendar were split, with roughly half of the participants valuing it and half not valuing. All participants agreed that the address entry starting from the country was not of value. This is consistent with the other preference data.

Table 19

Frequency Count of Increased Monetary Value of Modified Interface

	# of participants
$0	10
$25-$50	8
$51-$75	7
$76-$100	11
$100+	4

Participants were asked how much more they would be willing to pay for the modified interface. 75% of all the participants would be willing to pay more for the modified interface. A good number (37.5%) would be willing to pay over $75 for the modified interface. However, these numbers need to be compared to what users felt the base price of the PDA was. In addition, this figure would need to be compared to the marketing and sales data for companies to decide if culturalization would be worth the investment.

Table 20

Frequency of Self-Reported Benefits of the Modified Interface

	# of Participants
Linker	29
Lunar Calendar	25
Nothing	3

Participants were asked what they felt the benefits of the modified interface were. Most answers centered around the linker and the lunar calendar, indicating that these are areas worth more investigation and that they are important to users. A few people felt that nothing was gained from the modified interface, but they were a minority.

Table 21

Frequency of Self-Reported Considerations for Evaluating a PDA

	# of Participants
Size	34
Price	38
Utility	14
Appearance	9
Screen Size	7
Other	18

Participants were also asked what the three most important considerations when evaluating a handheld device were. Most answers were on the size, price and utility. Utility includes the general usefulness of the device and the number of available applications for the device. Size is a physical limitation that is driven by the parts and the screen size (which also happened to be an important consideration). Another major consideration was "appearance." This had to do with the color and the "coolness" factor of the device – in other words, if the device looked good. Other considerations included whether the device had wireless capabilities, whether the device had gaming capabilities,

the speed of the processor, what operating system the device ran on, and the compatibility with other applications.

DISCUSSION

The hypothesis of this study was:

- A specific culture group (Chinese from Mainland China, but now in the United States) will show a statistically significant increase in performance for a culturally sensitive product (a modified PDA)
- A specific culture group (Chinese from Mainland China, but now in the United States) will show a statistically significant increase in preference for a culturally sensitive product (a modified PDA)

The main ANOVA for the research showed that there was a difference in the performance on the modified interface from the non-modified, with main effects on task and interface and a significant interaction between task and interface with respect to the dependent variable of time. While performance for the contact retrieval increased for the modified interface, address entry actually decreased. This may be because the reversal of the address order, although familiar in Chinese, could not be transported into an English interface and participants complained much about it.

Main Analysis

There are some aspects of culture that cannot be torn apart from the language. For example, in Chinese, the term *reqi* has no true English counterpart. The words can be translated literally to mean "hot air." However, this does not capture the essence of the term, which actually is a medical condition that describes an imbalance of *qi* in the body. A literal translation is not only incorrect, but also intelligible. In Western medicine, it is sometimes described by its symptoms – sore throat, dehydration, canker sores, etc. However, there is no word that describes the root cause, which is a buildup of "hot essences" in the body.

In relation to interface design, there are concepts that a designer may wish to embed into the interface that cannot be translated well into another language because that language does not support those concepts. Using the *reqi* example above, a program to help doctors that practice Chinese medicine would have a difficult time with an English interface. For this thesis, the researcher strove for a common baseline to have a more controlled analysis, but as learned from this experiment, this is not always possible.

Post Hoc Analysis

A post hoc analysis was aimed to show that the performance of the types of tasks was different on the non-modified and modified interfaces, and this was borne out. The address entry and contact retrieval tasks were shown to be significantly different on the modified interface. Input tasks in general had more keystrokes per task than retrieval tasks. Please refer to Appendix D for the tasks that users performed.

Linking Analysis

Linking activity appeared to have a trend, with the business contacts having the most links, followed by social contacts, followed by business/social contacts. The reason for this segregation is not clear from this research. It may be that business contacts have more need to be kept together. In addition, groups of friends may also be viewed as separate entities. However, people met at business social functions may be more disparate and people may feel that they may or may not see them again together as a group. Further research can investigate the causes.

Linking as a whole was also high – nearly 50% of all possible links were made, as presented in Table 5. In addition, all groups made links, regardless of the amount of time they had spent in the United States. Linking of contacts appears to be a feature that has a more general appeal, and is not just restricted to cultures that place an emphasis on relationships. I believe that this is an example of a case where modifications intended for other cultures are also found to be useful for the originating culture. Another example of this would be the table function in Microsoft Word. Tables were included originally for their Japanese customers, but were ported back to the English version when they discovered how useful it was (L. Shade, personal communication, June 16, 2004).

Lunar Calendar Analysis

Group 1 – those participants that had been in the United States for half a year or less – appeared to use the lunar calendar the most, as evidenced by the number of auspicious dates that they chose for the life events presented in the tasks. Although all participants chose a date for the date tasks, only a number of them chose a date that was actually auspicious for the type of event that they were presented with. However, this may not have been as important to participants in other groups. While the lunar calendar cannot faithfully be ported into English, the fact that this feature was in Chinese may have corrupted the results in the date search task. In addition, there were more "correct" social auspicious dates for the date search entry.

Subjective Data Analysis

From the subjective data, most of the opinions on the interfaces were neutral. One of the strongest sentiments was that participants did not like the address entry on the modified interface at all. The linker feature appeared to be valuable to most people, but still tended towards a neutral opinion. The lunar calendar was liked by some and disliked by others.

The complaints on the address entry change may appear to indicate that functional differences dominate the cultural. However, this may merely point to the existence of a certain class of features that may prove to be a barrier for culturalization because the users have been exposed to another culture for so long that they have acclimated. For the address entry modification in particular, the address order was cultural since some participants did indicate they understood the reasoning behind the change. However, perhaps this was just not the right way to address the user need. In retrospect, in a word processing application like Microsoft Word, users may appreciate a manifestation of this feature in the mail merge function so that it accurately places addresses on envelopes. While the input can follow the Western address format if that is what users are accustomed to, the arrangement may still need to follow the Chinese format to allow for proper mail etiquette.

The choice of the address format was based extrapolation from Hofstede's (1997) "Dimensions of Culture." Hofstede concluded that Chinese people in general were more communitarist, so the experimenter tried to incorporate the concept of seeing the self as

the smallest unit into the address format. From this experiment, even though a people may possess certain characteristics in general, the expression of the concepts still will present a challenge to the designer. Various studies (Del Galdo, 1990; Honold, 2000; Marcus, 2001) mention "cultural factors." As discussed below, how to divine what the "correct" factors are needs to be outlined by further research. Some studies, (Byer & Holtzblatt 1998; Honold, 2000) propose methods to discover the cultural layer, but they both deal with users that are not removed from the target environment.

Hofstede (1997) also mentioned that Chinese people tend to be hierarchical, leading to the inclusion of the linking mechanism for the address book. However, this turned out to be a high-value feature overall. From the results on the most-preferred features on a PDA, it may appear that some users actually preferred the ability to link *over* the ability to store contacts, even though the ability to link is *dependent* on the ability to store contacts. However, this may be because on the survey, users were asked only what they liked most about each interface. There were no relative preferences.

It would appear that the most important aspects when evaluating a PDA are price, size and utility. Price is something that would need to be set by a marketing department. Size is limited by engineering and the interface design team has little input on that. However, utility is the one that can be partially addressed by a good user interface. It also depends on what applications are available and other features.

Lessons Learned

Something to note about this study is that the sample size was based on pragmatics. Usually, in the lack of previous data regarding effect size, it would be safe to assume a medium effect size. However, findings from the literature review and the dearth on academic studies in this area led us to believe that the effect size would be at most small, but since there was not enough information to hedge an effect size, we went with pragmatics. As such, the null hypothesis cannot be rejected even if the tests showed no significance. Again, this was an exploratory study and one of the main lessons learned was that what studies in this area need to make headway on are the fundamentals, as discussed in the "Future Research" section below.

One of the things that this study has shed light on is that studies of this nature inherently cannot be controlled as standard research is. While striving to have an equal comparison, it just was not feasible. For example, as mentioned above, the lunar calendar could not be ported to English easily while still capturing its essence. The date search also led to a performance difference in more recent immigrants, but the way that the study was set up made it hard to compare because the measure was the number of "correct" auspicious days, but there was no way to tell exactly how the users chose a particular date.

This study was done with recent immigrants to the United States to mitigate the fact that this study was not done in China. However, studies of this type are best done in the target market itself, as Beu, et al. (2000) mentioned. For this study, that would be

China. To further control for being away from the target market, the participants were originally split into groups based on length of time in the United States. However, this distinction was not significant based on the data. This may have been due to the limited number of data points. The number of participants in this study was chosen based on pragmatics so perhaps a better method of determining the accurate number of participants to include would be beneficial for future researchers in this area.

Implications

As per the data, there were performance and preference differences between a non-modified interface and a modified interface for the target culture, Chinese. However, while there is a significant difference, this, by itself, is not enough to drive an investment for companies for culturalization of a product. Further research needs to be done.

As mentioned above, price is one of the major factors in evaluating a PDA. Cultural considerations do appear to have an impact on the acceptance of a new product. Attention to this area could translate into higher profits for companies seeking to expand their markets into new areas and cultures. However, companies must also be prepared to go through extensive research. The research here shows that people have different affinities for different features and research must be done to verify if the features chosen are, in fact, suitable for the target market. It could turn out that the initial investment in culturalization would not generate a return on investment. If this is true, then companies probably will not choose to culturalize. Though culturalization makes a difference, only

when it makes a profit will it begin to be considered in companies. However, satisfied customers and a solid entry into a new market are the potential rewards.

Future Research

This study is limited in scope and thus generalizibility and is but a small contribution to the area of culturalization. However, there is both business and academic research to be done. Commercial companies are interested in this space for the marketing opportunities it brings and academics are interested in this space for the interactions of different cultures with various interfaces.

An interesting step in business research is to study how the concept of the PDA fits into Chinese culture. Although PDAs are in use in China, the basic functions of a PDA are marketed for the busy organized professional, but use has spread beyond the professional market. In order for the PDA to be optimally successful, the concepts "personal," "digital," and "assistant" must be redefined for the Chinese market. Also, an in-depth study on the increase in customers relative to the increase in cost may be useful to companies considering a culturalization project.

For academic research, since culturalization is a relatively new field, evidenced by the small number of academic studies on the subject as discussed in the literature review, it would behoove future studies to return to the basics. As the literature review presented, much of the "research" in this area has been market-driven. Studies on which research methods are best, how to choose culturally-salient variables, where to draw the line between a feature and a culturally-enhanced modification, and even studies on the

degree to which people actually prefer translated materials would all provide needed information to aid researchers in this area. "The *cultural context* is to us like water to a fish – pervasive and inescapable, yet invisible and intangible." (Byer & Holtzblatt, 1998, pg. 108) Studies that help discover how to get at the invisible layer will benefit the field greatly. Byer and Holtzblatt mention culture more in the organizational culture sense; dealing with parsing culture in an ethnic sense will require a generalization or other methods. However, the emphasis remains on user observation in real-world settings.

CONCLUSION

This study was a preliminary exploration of the effects of culture on the acceptance of software. The lack of attention to the cultural aspects of software acceptance was the primary reason for the study. The results indicate that cultural-based functions do impact user performance, sometimes in a positive manner and sometimes in a negative manner.

While this initial research is encouraging, this study was limited in several areas, the most prominent being that the study did work with participants somewhat removed from the target culture (immigrants), even though every care was made to find participants close to the target culture (recent immigrants). Companies seeking to enter new markets should ideally perform research in the country and culture that they are targeting. In addition, care should be taken with how a mobile computing device, such as a PDA, would fit into users' lifestyles when deciding on feature offerings.

There is a trend in the software industry to move towards culturalization, where culturalized versions of software are expected. Previously, users were willing to put up with inadequate interfaces in exchange for greater functionality, but now with companies shifting towards better culturalized products and demands for *relevant* functionality, users are not settling for half-culturalized products any longer. More and more businesses are finding business opportunities overseas and with the growth of the Internet, culturalized materials have become critical.

However, the current state of culturalization of software products is not much more than translations and minor technical details, such as date formats and special symbols. I assert that companies need to realize the importance of the cultural impact on perception and use of software and must begin to design with these factors in mind. In addition, I suggest designers should develop frameworks to ensure culturability in products to produce adequately culturalized releases as well as tools to measure the extent a product has been culturalized. Small steps have been taken in this direction, but there is still a long way to go. However, the goal remains the same – to effectively provide a solution to customer's workflows, which means taking into account cultural nuances.

The main lesson from this thesis is that studies in this area need to focus on the fundamentals. Studies in this area are confronted with a fundamental dilemma in the field of human factors – run a tightly controlled experiment or observe use of an artifact in context. Culture and language are living artifacts and very much tied to each participant in a study. This amounts to heuristic testing in an open-ended world, but heuristics are fallible by their nature and this experiment as severely limited to keep it in scope. Culturalization deals with putting a part of humanity – culture, which is ever-changing – into a static product.

Perhaps a better experiment would have been to see how different participants react to an already-released product in order to discern the relevant variables. However, the problem there is that users rarely use a system in the way their creators intended – they invariably put workarounds in when things do not fit their workflows.

Culturalization needs to reach a state where it can recognize those "workarounds" as problem areas and design effective ways to aid the user in his work.

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APPENDIX A. SCREENING DOCUMENT

1. What is your age? _____
2. What is your sex? _____Male _____ Female
3. What is your ethnicity? _____
4. Are you an immigrant to the United States? _____Yes _____ No
5. What is your original country of origin? _____
6. How long have you lived in the United States _____
7. What culture do you see yourself belonging to? _____
8. Do you identify with the Chinese culture? _____Yes _____ No
9. Do you use a PDA? _____Yes _____ No

Name	
Home Phone Number	
Work Phone Number	
E-mail	

APPENDIX B. AGREEMENT TO PARTICIPATE IN RESEARCH

Responsible Investigator(s): Serena Gee
Title of Protocol: Product Culturalization

1. You have been asked to participate in a research study investigating the purpose of the study is to determine the effects of culturalization on product design.

2. You will be asked to interact with a prototype of a Personal Data Assistant (PDA). Experimental procedures will last for a single session, roughly an hour long in which you will be given a set of scenarios to perform with the prototype. The session will be followed by a short debriefing session.

3. No risk to you during this session is anticipated.

4. No discernable direct benefits to you will come from this research. However, an indirect benefit may be that software products in the future will be easier to use if companies accept this and similar research and begin to culturalize products.

5. Although the results of this study may be published, no information that could identify you will be included.

6. There will be no compensation for participation in this research.

7. Questions about this research may be addressed to Serena Gee, 415.810.5184. Complaints about the research may be presented to Dr. Kevin Corker, Director of the Graduate Program in Human Factors/Ergonomics, Industrial & Systems Engineering Department, College of Engineering, at (408) 924-3988. Questions about research subjects' rights, or research-related injury may be presented to Nabil Ibrahim, Ph.D., Associate Vice President, Graduate Studies and Research, at (408) 924-2480.

8. No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose to "not participate" in the study.

9. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with San José State University or with any other participating institutions or agencies.

10. At the time that you sign this consent form, you will receive a copy of it for your records, signed and dated by the investigator.

- **The signature of a subject on this document indicates agreement to participate in the study.**

- **The signature of a researcher on this document indicates agreement to include the above named subject in the research and attestation that the subject has been fully informed of his or her rights.**

_____ _____

Signature Date

_____ _____

Investigator's Signature Date

APPENDIX C. WRITTEN INSTRUCTIONS

Personal Data Assistant Prototype

You are now sitting in front of a prototype of a proposed Personal Data Assistant (PDA). You will be asked to perform a series of tasks using this piece of equipment. As you can see, located in front of you is the list of scenarios. This will be your guide. The objective of the task is to read each scenario on the list, pretend that you are the person executing the scenario and to use the prototype to accomplish the tasks to the best of your ability. Do you have any questions?

You are free to take as long as you would like on each scenario. I cannot answer any questions on how to execute each scenario, though I will be in the room to observe as well as answer general questions if you do not understand the scenario. Are there any questions?

There is no "right" or "wrong" action. This study will assess *proposed* functionality for this product. Please merely attempt to proceed through the tasks as quickly and as accurately as possible. When you are about to begin a new task, please press the "Start" button that will be on the screen. When you are done, please press the "Stop" button, which will appear on the screen. Is that clear?

If at any time you feel you cannot proceed with the experiment, please notify the experimenter. Any further questions?

APPENDIX D-1. SEQUENCE OF ACTIONS – VERSION A

Situation 1

You're at a party that your boss is hosting. You've been mingling all night and have collected names and information from the following people:

Terry McGuire Director of Engineering Adobe Systems Inc. 345 Park Avenue San José, CA 95110 Tel: 408.536.6000 Email: tmcguire@adobe.com
WeiZhong Pan Account Manger WindRiver Systems China PRC Pudong New Area 480 Pu Dian Road , Pos Plaza, 28/F Tel: 86-21-5830-9319/20 x804 Email: wpan@windriver.com
Stephen JingXin Zhao Application Engineering WindRiver Systems B5, Flat 7 10 Conifer Street GongBei, ZhuHai Canton, China Tel: 86-21-5830-1662 Email: szhao@windriver.com
Jane Willis Quality Engineer Adobe Systems Inc. 345 Park Avenue San José, CA 95110 Tel: 408.536.6000 Email: jwillis@adobe.com
Glen Fujimori Sales Manager, Asia Adobe Systems Inc. 345 Park Avenue San José, CA 95110

Tel: 408.536.6000 Email: gfujimori@adobe.com

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. Enter a meeting with Terry McGuire on July 15, 2003 at 11am.
4. Enter a meeting with Jane Willis on June 27, 2003 at 2pm.
5. Find all the people that work for Adobe Systems that you met at the party.

Situation 2

You're cleaning out your old address book and moving to a PDA. You have a list of friends from high school that you want to enter. They are:

Sean Xu 3901 North First Street San Francisco, CA 94112 Email: sxu@hotmail.com
Cindy Zhou Tel: 510.566.1234 Email: czhou@hotmail.com
Nancy Huang 101 Jefferson Avenue Sunnyvale, CA 95049 Tel: 408.656.7841 Email:nhuang@earthlink.com
Tim Ng Tel: 650.128.4789 Email: tng@yahoo.com
Bruce Lim 45 Monroe Avenue Foster City, CA 94002 Tel: 650.478.1279 Email: blim@jps.net

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. Enter a birthday party with Sean Xu on June 28, 2003 at 6pm.
4. Enter a dinner with the group on July 5, 2003 at 7pm.
5. You need to compose a mass mail to all of them. Find all your high school friends.

Situation 3

You are at a developer's conference and you've met several useful contacts from several product groups. They give you their business cards:

Haiyi Xu Director of Engineering WindRiver Systems China, Chaoyang District Xibahe Dongli Sanyuan Mansion, No.18 Room 2101 Tel: 86-21-5830-9319 Email: hxu@windriver.com
Jessie Wang Quality Engineer WindRiver Systems China, Chaoyang District Xibahe Dongli Sanyuan Mansion, No.18 Room 2101 Tel: 86-21-5830-9319 Email: jwang@windriver.com
Robert Chu Application Engineering IBM B5, Flat 7 10 Conifer Street GongBei, ZhuHai Canton, China Tel: 86-21-7895-4126 Email: rchu@ibm.com
Olivia Pan Application Engineering IBM B5, Flat 7 10 Conifer Street GongBei, ZhuHai Canton, China Tel: 86-21-7895-4126 Email: opan@ibm.com
YingYing Ho Quality Engineer WindRiver Systems

China, Chaoyang District
Xibahe Dongli
Sanyuan Mansion, No.18
Room 2101
Tel: 86-21-5830-9319
Email: yho@windriver.com

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. You notice that you entered the information for Olivia Pan wrong. The phone number should be 86-21-7895-4123. Please correct it.
4. Enter a trip to LA on July 4, 2003.
5. You need to invite all of the quality engineering team to a meeting on July 23, 2003 at 3pm, but you only remember that YingYing Ho is in that team. Please find all of the contacts that you have from that team.

Situation 4

Your own side business is about to have its grand opening and you need to decide when to hold the festivities.

1. Decide on a date.
2. Mark it in the Datebook.

Situation 5

You are going to get married in October.

1. Decide on a date.
2. Mark it in the Datebook.

APPENDIX D-2. SEQUENCE OF ACTIONS – VERSION B

Situation 1

You went to a networking affair after a class in database administration. After talking with several classmates, you've collected the following information:

John Almlof Vice President of Marketing Palm, Inc. 10 Tara Blvd, Suite 130 Nashua, CA 97852 Tel: 603.897.2156 Email: jalmlof@palm.com
Jianbing Liu Account Manger WindRiver Systems China PRC Pudong New Area 480 Pu Dian Road , Pos Plaza, 28/F Tel: 86-21-5830-9319/20 x818 Email: jliu@windriver.com
Donald Richardson Senior Engineer Palm, Inc. 10 Tara Blvd, Suite 130 Nashua, CA 97852 Tel: 603.897.2158 Email: drichardson@palm.com
Li Ning Account Manger WindRiver Systems China PRC Pudong New Area 480 Pu Dian Road , Pos Plaza, 28/F Tel: 86-21-5830-9319/20 x856 Email: lning@windriver.com
Karen Cross Senior Engineer Palm, Inc. 10 Tara Blvd, Suite 130 Nashua, CA 97852

Tel: 603.897.2178 Email: kcross@palm.com

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. Enter a meeting with Karen Cross on August 26, 2003 at 9am.
4. Enter an additional number (Cell: 408.579.8635) for Donald Richardson.
5. Find all the people that work for Palm that you met at this affair.

Situation 2

You're cleaning out your old address book and moving to a PDA. You have a list of friends from college that you want to enter. They are:

Blendy Wan Tel: 408.623.8760 Email: blendy@sbglobal.net
James Yi 56 Dekker Terrace Fremont, CA 94709 Tel: 650.536.7854 Email: james@.lmf.com
Danny Tang Tel: 415.658.9631 Email: dteng@yahoo.com
Mandy Ng 263 Gaven Street San Francisco, CA 94118 Tel: 415.468.5789 Email: mandy@.eathlink.net
Julia Chen Tel: 650.789.3214 Email: jchen@.hotmail.com

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. Enter an extra number (Cell: 415.896.2475) for Mandy Ng.
4. Enter a lunch with the group on August 15, 2003 at 12pm.
5. You need to compose a mass mail to all of them to organize a group picnic. Find all your college friends.

Situation 3

You are at the company meeting and you see a person in the group that you've been trying to contact without success. Seeing an opportunity, you casually walk over and strike up a conversation. Successful, you walk away with the following information:

Sarah Kong Project Manager PeopleSoft Inc. 6091 Bower Rd. San José, CA 95112 Tel: 408.387.3856 Email: skong@peoplesoft.com
WeiJiang Feng Technical Support WindRiver Systems China, Chaoyang District Xibahe Dongli Sanyuan Mansion, No.18 Room 2101 Tel: 86-21-5830-9326 Email: wfeng@windriver.com
Jeffrey Honig Quality Engineer PeopleSoft Inc. 6091 Bower Rd. San José, CA 95112 Tel: 408.387.3822 Email: jhonig@peoplesoft.com
Zuqiang Wang IS WindRiver Systems China, Chaoyang District Xibahe Dongli Sanyuan Mansion, No.18 Room 2101 Tel: 86-21-5830-9391 Email: zwang@windriver.com
Meng Hao Technical Support WindRiver Systems China, Chaoyang District Xibahe Dongli Sanyuan Mansion, No.18

Room 2101
Tel: 86-21-5830-9337
Email: mhao@windriver.com

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. Enter a doctor's appointment on July 31 at 11am.
4. Enter a mechanic's appointment on August 4, 2003 at 2pm.
5. You need to invite all of the technical support team to a meeting on September 5, 2003 at 1pm, can only remember Meng Hao. Please find all of the contacts that you have from that team.

Situation 4

Your company decides to build another building adjacent to the current one because it is increasing in size. You are in charge of this project.

1. Decide on a date for the construction to begin.
2. Mark it in the Datebook.

Situation 5

You've bought a new house and the paperwork has just settled. You're ready to move into the new house.

1. Decide on a date.
2. Mark it in the Datebook.

APPENDIX D-3. SEQUENCE OF ACTIONS – VERSION C

Situation 1

Your own side business is about to have its grand opening and you need to decide when to hold the festivities.

1. Decide on a date.
2. Mark it in the Datebook.

Situation 2

You are going to get married in October.

1. Decide on a date.
2. Mark it in the Datebook.

Situation 3

You're at a party that your boss is hosting. You've been mingling all night and have collected names and information from the following people:

Terry McGuire Director of Engineering Adobe Systems Inc. 345 Park Avenue San José, CA 95110 Tel: 408.536.6000 Email: tmcguire@adobe.com
WeiZhong Pan Account Manger WindRiver Systems China PRC Pudong New Area 480 Pu Dian Road , Pos Plaza, 28/F Tel: 86-21-5830-9319/20 x804 Email: wpan@windriver.com
Stephen JingXin Zhao Application Engineering WindRiver Systems B5, Flat 7 10 Conifer Street GongBei, ZhuHai Canton, China Tel: 86-21-5830-1662 Email: szhao@windriver.com
Jane Willis

Quality Engineer Adobe Systems Inc. 345 Park Avenue San José, CA 95110 Tel: 408.536.6000 Email: jwillis@adobe.com
Glen Fujimori Sales Manager, Asia Adobe Systems Inc. 345 Park Avenue San José, CA 95110 Tel: 408.536.6000 Email: gfujimori@adobe.com

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. Enter a meeting with Terry McGuire on July 15, 2003 at 11am.
4. Enter a meeting with Jane Willis on June 27, 2003 at 2pm.
5. Find all the people that work for Adobe Systems that you met at the party.

Situation 4

You're cleaning out your old address book and moving to a PDA. You have a list of friends from high school that you want to enter. They are:

Sean Xu 3901 North First Street San Francisco, CA 94112 Email: sxu@hotmail.com
Cindy Zhou Tel: 510.566.1234 Email: czhou@hotmail.com
Nancy Huang 101 Jefferson Avenue Sunnyvale, CA 95049 Tel: 408.656.7841 Email:nhuang@earthlink.com
Tim Ng Tel: 650.128.4789 Email: tng@yahoo.com
Bruce Lim 45 Monroe Avenue Foster City, CA 94002

Tel: 650.478.1279 Email: blim@jps.net

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. Enter a birthday party with Bruce Lim on June 28, 2003 at 6pm.
4. Enter a dinner with the group on July 5, 2003 at 7pm.
5. You need to compose a mass mail to all of them. Find all your high school friends.

Situation 5

You are at a developer's conference and you've met several useful contacts from several product groups. They give you their business cards:

Haiyi Xu Director of Engineering WindRiver Systems China, Chaoyang District Xibahe Dongli Sanyuan Mansion, No.18 Room 2101 Tel: 86-21-5830-9319 Email: hxu@windriver.com
Jessie Wang Quality Engineer WindRiver Systems China, Chaoyang District Xibahe Dongli Sanyuan Mansion, No.18 Room 2101 Tel: 86-21-5830-9319 Email: jwang@windriver.com
Robert Chu Application Engineering IBM B5, Flat 7 10 Conifer Street GongBei, ZhuHai Canton, China Tel: 86-21-7895-4126 Email: rchu@ibm.com
Olivia Pan

Application Engineering IBM B5, Flat 7 10 Conifer Street GongBei, ZhuHai Canton, China Tel: 86-21-7895-4126 Email: opan@ibm.com
YingYing Ho Quality Engineer WindRiver Systems China, Chaoyang District Xibahe Dongli Sanyuan Mansion, No.18 Room 2101 Tel: 86-21-5830-9319 Email: yho@windriver.com

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. You notice that you entered the information for Olivia Pan wrong. The phone number should be 86-21-7895-4123. Please correct it.
4. Enter a trip to LA on July 4, 2003.
5. You need to invite all of the quality engineering team to a meeting on July 23, 2003 at 3pm, but you only remember that YingYing Ho is in that team. Please find all of the contacts that you have from that team.

APPENDIX D-4. SEQUENCE OF ACTIONS – VERSION D

Situation 1

Your company decides to build another building adjacent to the current one because it is increasing in size. You are in charge of this project.

1. Decide on a date for the construction to begin.
2. Mark it in the Datebook.

Situation 2

You've bought a new house and the paperwork has just settled. You're ready to move into the new house.

1. Decide on a date.
2. Mark it in the Datebook.

Situation 3

You went to a networking affair after a class in database administration. After talking with several classmates, you've collected the following information:

John Almlof Vice President of Marketing Palm, Inc. 10 Tara Blvd, Suite 130 Nashua, CA 97852 Tel: 603.897.2156 Email: jalmlof@palm.com
Jianbing Liu Account Manger WindRiver Systems China PRC Pudong New Area 480 Pu Dian Road , Pos Plaza, 28/F Tel: 86-21-5830-9319/20 x818 Email: jliu@windriver.com
Donald Richardson Senior Engineer Palm, Inc. 10 Tara Blvd, Suite 130 Nashua, CA 97852 Tel: 603.897.2158 Email: drichardson@palm.com
Li Ning

Account Manger WindRiver Systems China PRC Pudong New Area 480 Pu Dian Road , Pos Plaza, 28/F Tel: 86-21-5830-9319/20 x856 Email: lning@windriver.com
Karen Cross Senior Engineer Palm, Inc. 10 Tara Blvd, Suite 130 Nashua, CA 97852 Tel: 603.897.2178 Email: kcross@palm.com

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. Enter a meeting with Karen Cross on August 26, 2003 at 9am.
4. Enter an additional number (Cell: 408.579.8635) for Donald Richardson.
5. Find all the people that work for Palm that you met at this affair.

Situation 4

You're cleaning out your old address book and moving to a PDA. You have a list of friends from college that you want to enter. They are:

Blendy Wan Tel: 408.623.8760 Email: blendy@sbglobal.net
James Yi 56 Dekker Terrace Fremont, CA 94709 Tel: 650.536.7854 Email: james@.lmf.com
Danny Tang Tel: 415.658.9631 Email: dteng@yahoo.com
Mandy Ng 263 Gaven Street San Francisco, CA 94118 Tel: 415.468.5789 Email: mandy@.eathlink.net
Julia Chen

Tel: 650.789.3214 Email: jchen@.hotmail.com

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. Enter an extra number (Cell: 415.896.2475) for Mandy Ng.
4. Enter a lunch with the group on August 15, 2003 at 12pm.
5. You need to compose a mass mail to all of them to organize a group picnic. Find all your college friends.

Situation 5

You are at the company meeting and you see a person in the group that you've been trying to contact without success. Seeing an opportunity, you casually walk over and strike up a conversation. Successful, you walk away with the following information:

Sarah Kong Project Manager PeopleSoft Inc. 6091 Bower Rd. San José, CA 95112 Tel: 408.387.3856 Email: skong@peoplesoft.com
WeiJiang Feng Technical Support WindRiver Systems China, Chaoyang District Xibahe Dongli Sanyuan Mansion, No.18 Room 2101 Tel: 86-21-5830-9326 Email: wfeng@windriver.com
Jeffrey Honig Quality Engineer PeopleSoft Inc. 6091 Bower Rd. San José, CA 95112 Tel: 408.387.3822 Email: jhonig@peoplesoft.com
Zuqiang Wang IS WindRiver Systems China, Chaoyang District

Xibahe Dongli Sanyuan Mansion, No.18 Room 2101 Tel: 86-21-5830-9391 Email: zwang@windriver.com
Meng Hao Technical Support WindRiver Systems China, Chaoyang District Xibahe Dongli Sanyuan Mansion, No.18 Room 2101 Tel: 86-21-5830-9337 Email: mhao@windriver.com

1. Enter these people into your contacts.
2. Note any relations that you wish to.
3. Enter a doctor's appointment on July 31 at 11am.
4. Enter a mechanic's appointment on August 4, 2003 at 2pm.
5. You need to invite all of the technical support team to a meeting on September 5, 2003 at 1pm, can only remember Meng Hao. Please find all of the contacts that you have from that team.

APPENDIX E-1. TRAINING PROCEDURES – NON-MODIFIED PDA

This will be a short training exercise that will take roughly 15-20 minutes to familiarize you with this software. If you have any questions at this point, please don't hesitate to ask, but keep in mind that I will not be able to answer any questions about the functionality of the product.

1. Click on the "Contacts" button with the mouse.
2. Enter the following information as a new contact:
   Name: Alan Cotter
   Title: VP of Marketing, Oracle
   Phone: 415.236.4568
   Address: 123 Main Street, San Francisco, CA 94112
3. Click on the "Datebook" with the mouse.
4. Enter a random meeting in the schedule by clicking on a time and then typing some text to name the meeting.
5. Click back to "Contacts" and look up Alan Cotter.
6. Click to the Datebook and locate your meeting.

APPENDIX E-2. TRAINING PROCEDURES – MODIFIED PDA

This will be a short training exercise that will take roughly 15-20 minutes to familiarize you with this software. If you have any questions at this point, please don't hesitate to ask, but keep in mind that I will not be able to answer any questions about the functionality of the product.

1. Click on the "Contacts" button with the mouse.
2. Enter the following information as a new contact:
   Name: Jane Willis
   Title: Quality Engineer, Adobe Systems
   Phone: 555.555.5555
   Address: China, Canton, Sham Shui Po, Diamond Hill, Flat 5-B
3. Enter the following information as a new contact:
   Name: Jeff Lee
   Title: Quality Engineering Lead, Adobe Systems
   Phone: 555.555.1234
   Address: China, Canton, Sham Shui Po, Diamond Hill, Flat 5-B
4. Click on the "link" button and link Jeff to Jane, since they work for the same company and are related in that way.
5. Click on the "Datebook" with the mouse.
6. Enter a random meeting in the schedule by clicking on a time and then typing some text to name the meeting.
7. Click the lunar calendar bar.
8. See what is auspicious for that day.
9. Click back to the contacts.
10. Locate "Jane Willis."
11. Click the link button and see who she is linked to.
12. Click back to your meeting.

APPENDIX F. TEST GUIDE

Introduction questions (3 minutes)

1. How much do you like PDAs in general?
   Not at all Very Much
   1 2 3 4 5 6 7

2. How much would you pay for a PDA now, if you had to guess?

3. What are some features that you must have with a PDA?

Introduce concept (2 minutes)
You'll be providing feedback about some proposed functionality in a PDA that is localized for Chinese users.

We will be using mockups on screen to simulate the experience.

Entering the names lists/retrieving information

1. Will the user use the link function?
2. Will the user put in the address in, starting from the zip code?
3. Ask the user what s/he thinks the link icon is.
4. Will the user put in the address in, starting from the zip code?

Choosing dates

1. Will the user use the lunar calendar?

Overall Survey Questions
The user will be given a post interaction survey, found in Appendix H.

Debrief
Users will be informed that they took part in giving feedback on the features that might be considered for a PDA targeted towards the Chinese market. Topics to be discussed will be the significance of:

- The lunar calendar
- The linking function
- Address input order

APPENDIX G. INTERFACE PRESENTATION MATRIX

Below is the matrix on the different variations of presentation of the following items:

- Type of interface – modified or non-modified
- Choose date first/addresses first

All tasks lists contain both a social and business date element and a social and business usage of the address book, including the following:

- Type of lunar calendar date to input – either social, as in a wedding; or business, as in the opening of a new store
- Direction of the address presentation – either "forwards," from house number to country; or "backwards," from country to house number

Table 22

Counterbalancing Matrix

Interface Type	**First Task**
Non-Modified	Date
Modified	Date
Non-Modified	Address
Modified	Address

In the table above, we see that there are four presentation possibilities over two presentation variables, since the task list contains all of the other variables (date type and address type). One participant in each group will need to take two of the scenarios since they will be interacting with both interfaces. Each pair is highlighted in different colors in the table above. However, each scenario needs to be repeated twice alternating between the presentation order of the modified and non-modified interfaces, meaning there needs to be at least four participants per subgroup and the entire group should be repeated once (8 trials per subgroup), bringing the total number of minimum participants needed to forty.

The schedule will be as follows, with the first interaction set highlighted in blue and the second interaction set highlighted with yellow:

Table 23

Presentation Schedule

Participant	Interface	First Task	Interface	First Task
1	Non-Modified	Date	Modified	Address
2	Modified	Address	Non-Modified	Date
3	Modified	Date	Non-Modified	Address
4	Non-Modified	Address	Modified	Address
5	Non-Modified	Date	Modified	Address
6	Modified	Address	Non-Modified	Date
7	Modified	Date	Non-Modified	Address
8	Non-Modified	Address	Modified	Address
9	Non-Modified	Date	Modified	Address
10	Modified	Address	Non-Modified	Date
11	Modified	Date	Non-Modified	Address
12	Non-Modified	Address	Modified	Address
13	Non-Modified	Date	Modified	Address
14	Modified	Address	Non-Modified	Date
15	Modified	Date	Non-Modified	Address
16	Non-Modified	Address	Modified	Address
17	Non-Modified	Date	Modified	Address
18	Modified	Address	Non-Modified	Date
19	Modified	Date	Non-Modified	Address
20	Non-Modified	Address	Modified	Address
21	Non-Modified	Date	Modified	Address
22	Modified	Address	Non-Modified	Date
23	Modified	Date	Non-Modified	Address
24	Non-Modified	Address	Modified	Address
25	Non-Modified	Date	Modified	Address
26	Modified	Address	Non-Modified	Date
27	Modified	Date	Non-Modified	Address

28	Non-Modified	Address	Modified	Address
29	Non-Modified	Date	Modified	Address
30	Modified	Address	Non-Modified	Date
31	Modified	Date	Non-Modified	Address
32	Non-Modified	Address	Modified	Address
33	Non-Modified	Date	Modified	Address
34	Modified	Address	Non-Modified	Date
35	Modified	Date	Non-Modified	Address
36	Non-Modified	Address	Modified	Address
37	Non-Modified	Date	Modified	Address
38	Modified	Address	Non-Modified	Date
39	Modified	Date	Non-Modified	Address
40	Non-Modified	Address	Modified	Address

APPENDIX H-1. POST INTERACTION SURVEY – NON-MODIFIED PDA

1. Overall impressions. *(Please circle one answer per row according to the answer that best matches your feelings about the statement in the first column.)*

	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
This interface was useful to me.	1	2	3	4	5
I felt that information input was comfortable.	1	2	3	4	5
I felt that information retrieval was awkward/difficult.	1	2	3	4	5
This interface appears user-centered.	1	2	3	4	5
I felt that information retrieval was comfortable.	1	2	3	4	5
I felt that information input was awkward/difficult.	1	2	3	4	5

2. Tasks. *(Please circle one answer per row according to the answer that best matches your feelings about the statement in the first column. Refer to the "Sequence of Actions" if necessary.)*

	Very Difficult	**Somewhat Difficult**	**Neutral**	**Somewhat Easy**	**Very Easy**
How easy or difficult was it to perform Task 1.	1	2	3	4	5
How easy or difficult was it to perform Task 2.	1	2	3	4	5
How easy or difficult was it to	1	2	3	4	5

perform Task 3.					
How easy or difficult was it to perform Task 4.	1	2	3	4	5
How easy or difficult was it to perform Task 5.	1	2	3	4	5

3. Did any aspect of the interface confuse you? (If yes, please explain.)

4. List two things that you liked **most** about this interface.
   - _____
   - _____

5. List two things that you liked **least** about this interface.
   - _____
   - _____

APPENDIX H-2. POST INTERACTION SURVEY – MODIFIED PDA

1. Overall impressions. *(Please circle one answer per row according to the answer that best matches your feelings about the statement in the first column.)*

	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
This interface was useful to me.	1	2	3	4	5
I felt that information input was comfortable.	1	2	3	4	5
I felt that information retrieval was awkward/difficult.	1	2	3	4	5
This interface appears user-centered.	1	2	3	4	5
I felt that information retrieval was comfortable.	1	2	3	4	5
I felt that information input was awkward/ difficult.	1	2	3	4	5

2. Tasks. *(Please circle one answer per row according to the answer that best matches your feelings about the statement in the first column. Refer to the "Sequence of Actions" if necessary.)*

	Very Difficult	**Somewhat Difficult**	**Neutral**	**Somewhat Easy**	**Very Easy**
How easy or difficult was it to perform Task 1.	1	2	3	4	5
How easy or difficult was it to perform Task 2.	1	2	3	4	5
How easy or difficult was it to	1	2	3	4	5

perform Task 3.					
How easy or difficult was it to perform Task 4.	1	2	3	4	5
How easy or difficult was it to perform Task 5.	1	2	3	4	5

3. Did any aspect of the interface confuse you? (If yes, please explain.)

4. List two things that you liked **most** about this interface.
   - _____
   - _____

5. List two things that you liked **least** about this interface.
   - _____
   - _____

6. In your own words, what does the link function in the Contacts section do?

APPENDIX H-3. POST INTERACTION SURVEY – COMPARATIVE

Participant # _____
A = _____

1. Overall impressions. *(Please circle one answer per row according to the answer that best matches your feelings about the statement in the first column.)*

	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
I preferred PDA Interface A.	1	2	3	4	5
I felt that the extra functions were useful.	1	2	3	4	5
Interface B met my needs more than Interface A.	1	2	3	4	5
Interface A appears to have more user-centered features that I can use.	1	2	3	4	5
Interface B is a significant improvement on Interface A.	1	2	3	4	5
I preferred PDA Interface B.	1	2	3	4	5

2. Tasks. *(Please circle one answer per row according to the answer that best matches your feelings about the statement in the first column. Refer to the "Sequence of Actions" if necessary.)*

	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
It was easier to perform Task 1 on Interface A.	1	2	3	4	5
It was easier to perform Task 2 on Interface A.	1	2	3	4	5
It was easier to	1	2	3	4	5

perform Task 3 on Interface A.					
It was easier to perform Task 4 on Interface A.	1	2	3	4	5
It was easier to perform Task 5 on Interface A.	1	2	3	4	5

3. User workflow. *(Please circle one answer per row according to the answer that best matches your feelings about the statement in the first column.)*

	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
I enter addresses beginning with the country.	1	2	3	4	5
I enter addresses beginning with the house number.	1	2	3	4	5
I consult a lunar calendar when planning personal events.	1	2	3	4	5
I consult a lunar calendar when planning business events.	1	2	3	4	5
I would record information on how people are related.	1	2	3	4	5

4. Value. *(Please circle one answer per row according to the answer that best matches your feelings about the statement in the first column in terms of how much you value the features **functional value**.)*

	Low Value	**Somewhat Low**	**Neutral**	**Somewhat High**	**High Value**
Linking function in Contacts	1	2	3	4	5
Lunar calendar	1	2	3	4	5

Addresses starting from country	1	2	3	4	5

5. Given these two PDA interfaces, how much MORE would you pay for the modified one? *(Please circle one)*
   $0 $25-$50 $50-$75 $75-$100 $100+

6. In your own words, what does the modified PDA provide you that you can't get from anywhere else?

7. The 3 most important things to me when considering a personal organizer are:
   - _____
   - _____
   - _____

8. What features, if any, did you feel was missing from the interface, with respect to contact and schedule management?
   - _____
   - _____
   - _____

9. What features do you feel are essential to a personal digital assistant?
   - _____
   - _____
   - _____

APPENDIX I. DATA LOG

Participant#:				S = Sensitive Area			C = Confusion		
Date:				F = Frustration			E = Other Error		
Recorder:				H = Hesitation			PD = Perceived Difficulty[1]		
Task	**Time**	**S**	**F**	**H**	**C**	**E**	**PD**	**Participant Comments**	**Notes**
Entering American address	Start: Stop:								
Entering Chinese address	Start: Stop:								
Search Task	Start: Stop:								
Entering American address	Start: Stop:								
Search Task	Start: Stop:								
Entering American address	Start: Stop:								
Entering Chinese address	Start: Stop:								
Search Task	Start: Stop:								
Finding a social date	Start: Stop:								
Finding a business date	Start: Stop:								

[1] Perceived Difficulty will be a rating from the experimenter on a scale from 1-5, ranging from "Very difficult" to "Very easy" on what the experimenter feels is the difficulty of the task for the participant. This will be compared with the participant's self reported ratings.

APPENDIX J. APPARATUS SCREENSHOTS

The following screenshots show the modified interface. The non-modified was basically the same, but without all the noted areas below.

Figure 4. Startup screen

This is what the user saw when they started the apparatus. This immediately will refresh to the main page (next page). The "Start" button was used to start the timer. If pushed, the button would change to "Stop" and could be toggled to stop the timer. Users were instructed on using this when they began and ended a task.

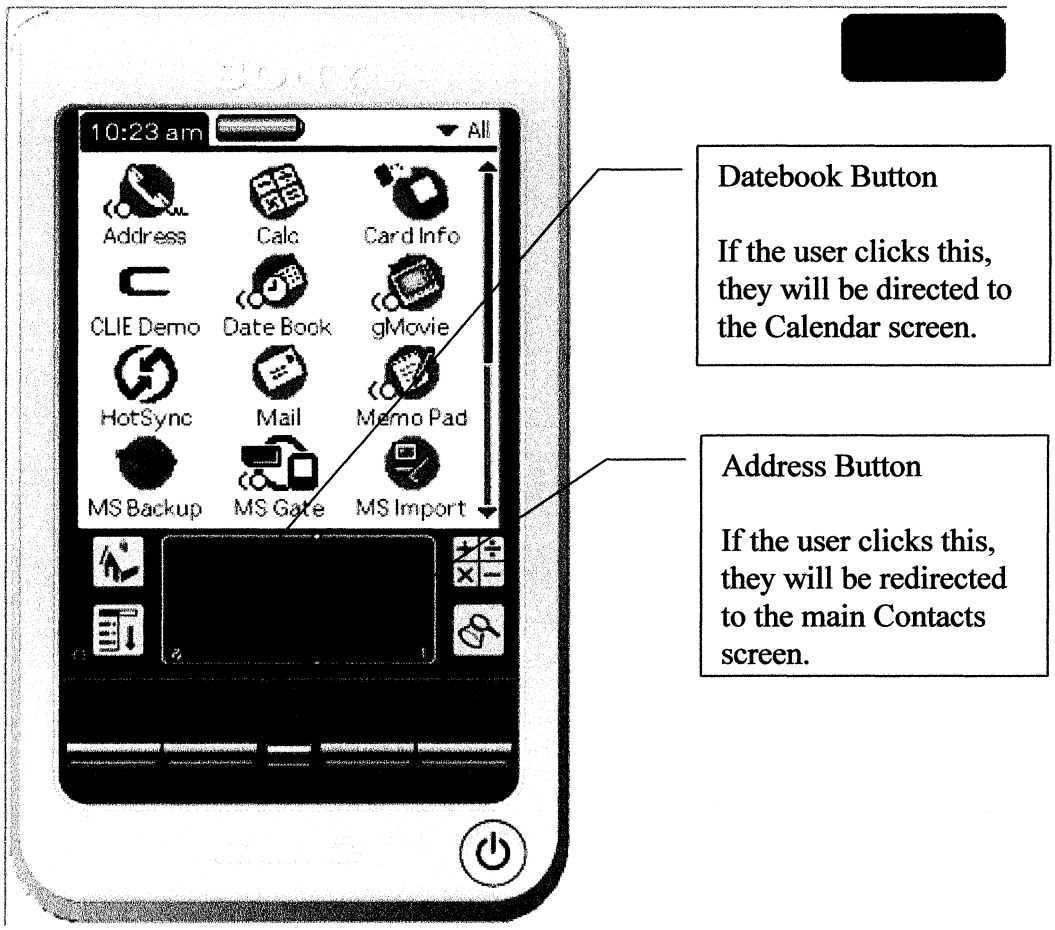

Figure 5. Main Screen

The user started with this screen.

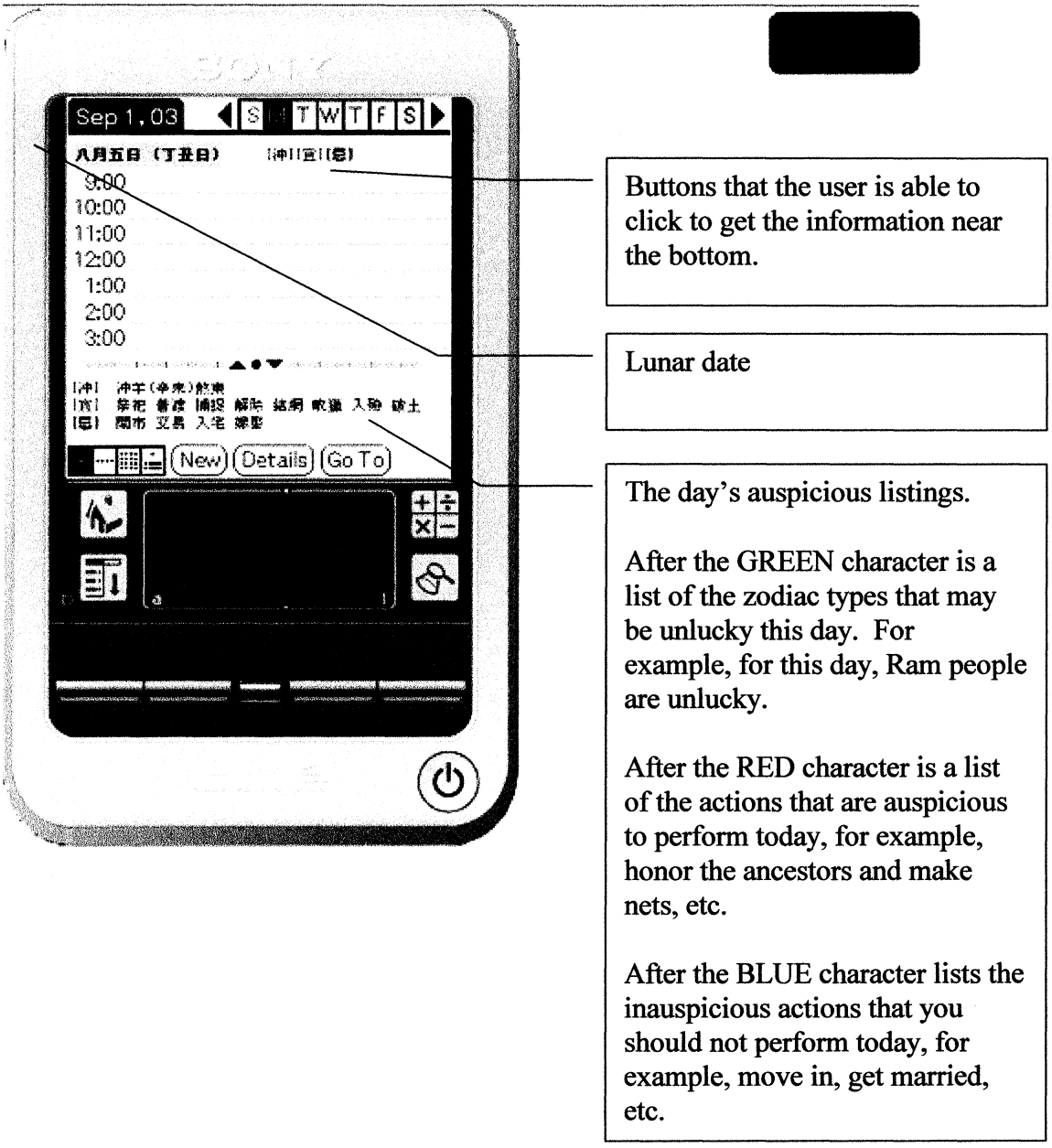

Figure 6. A sample datebook screen with integrated lunar calendar information.

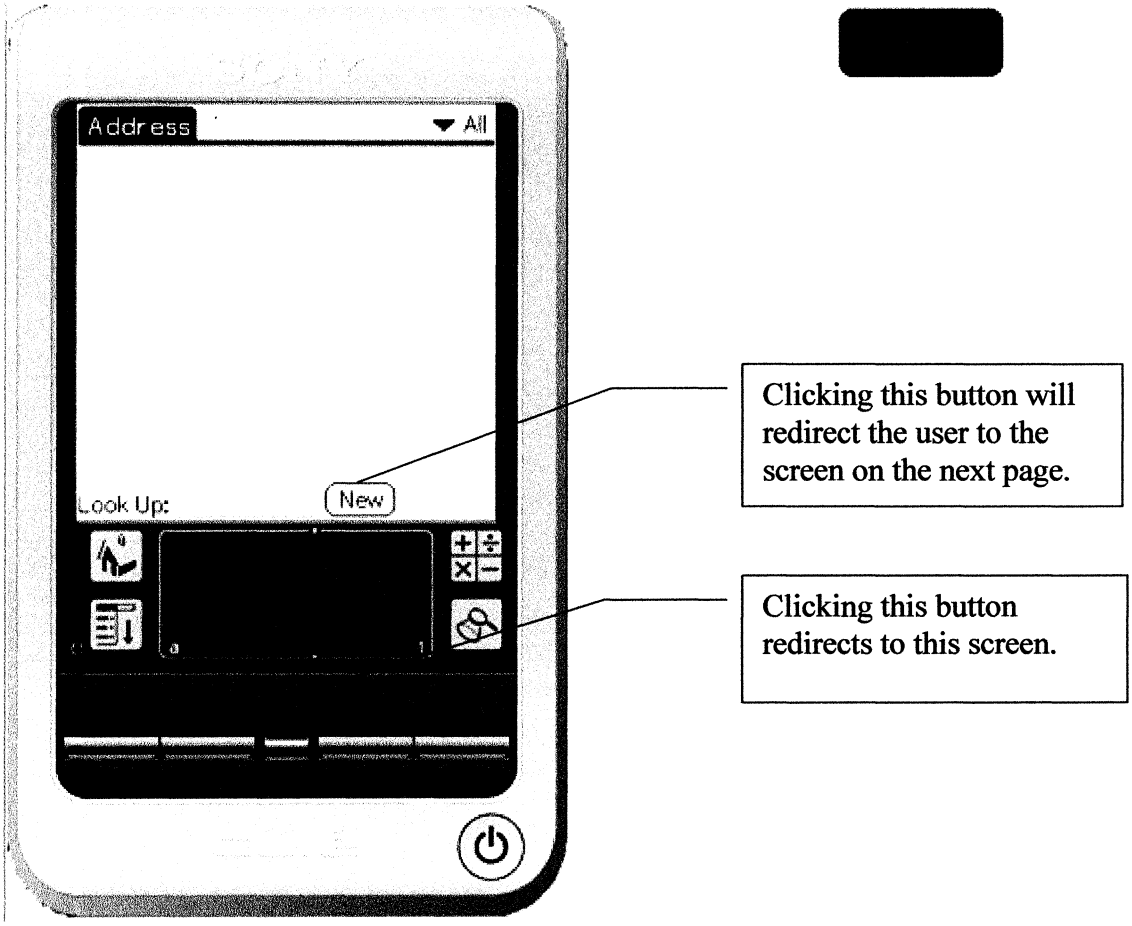

Figure 7. Main address screen – a lookup screen (same as the original Palm OS).

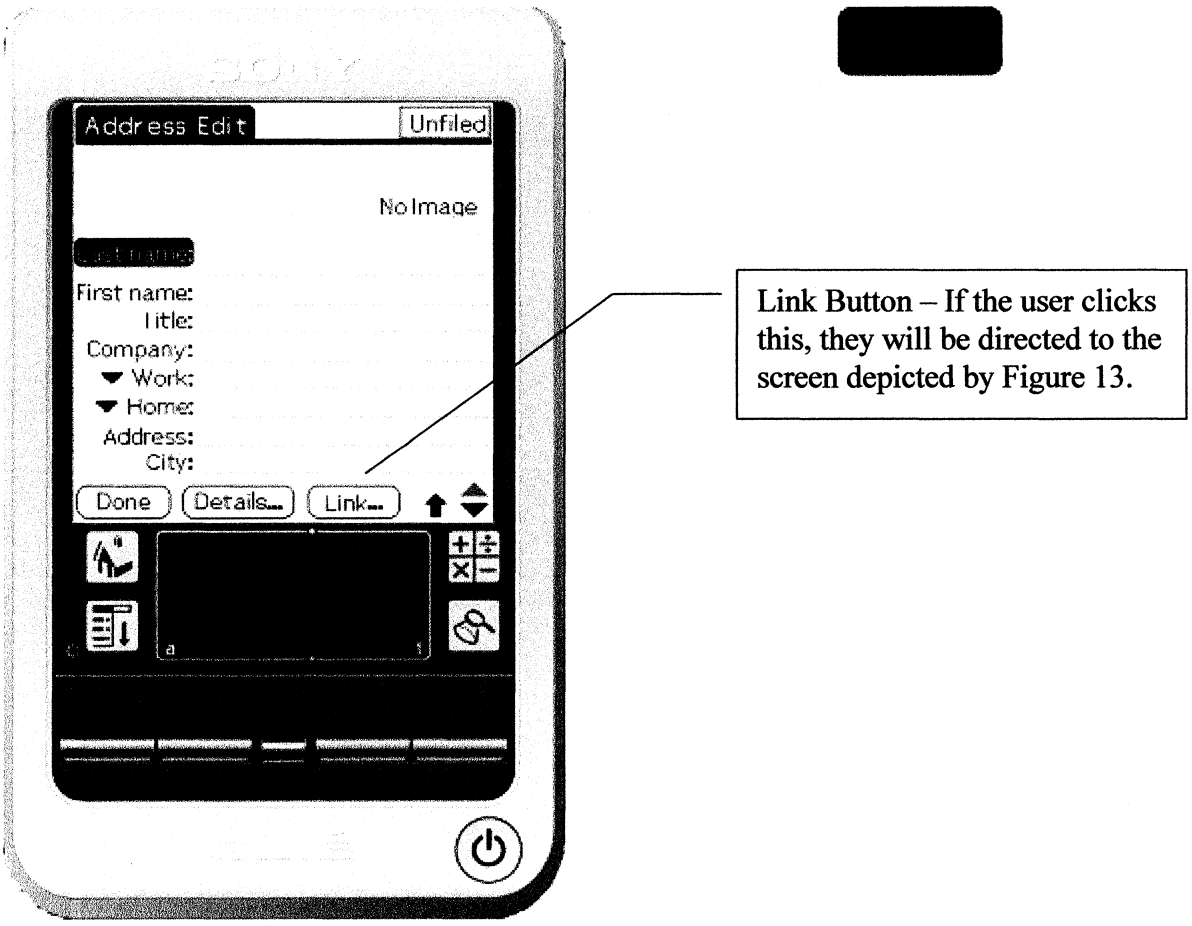

Figure 8. A new contact information screen (part 1)

The address input is in the American way (Street first). If the user clicks on the down arrow, the screen will scroll down.

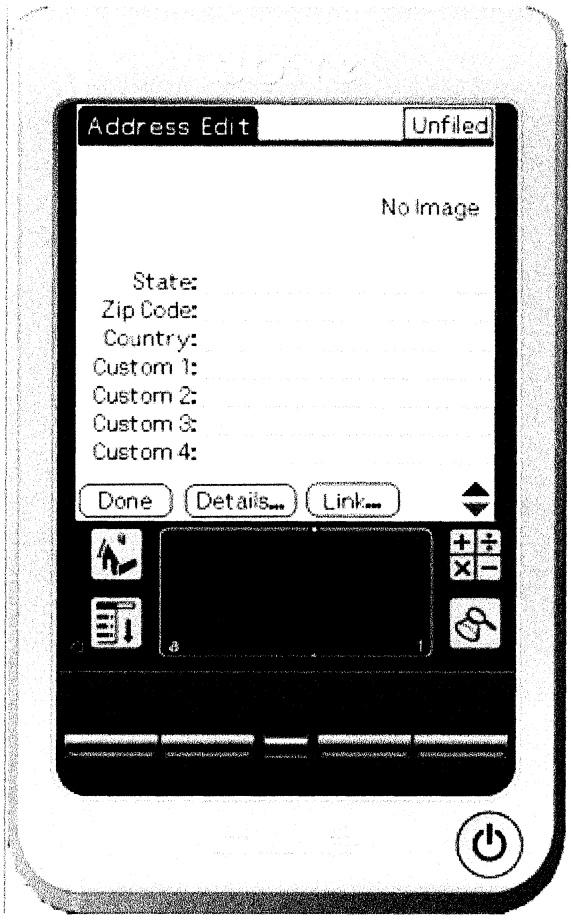

Figure 9. A new contact information screen (part 2)

The address input is in the American way (Street first). If the user clicks on the up arrow, the screen will scroll up.

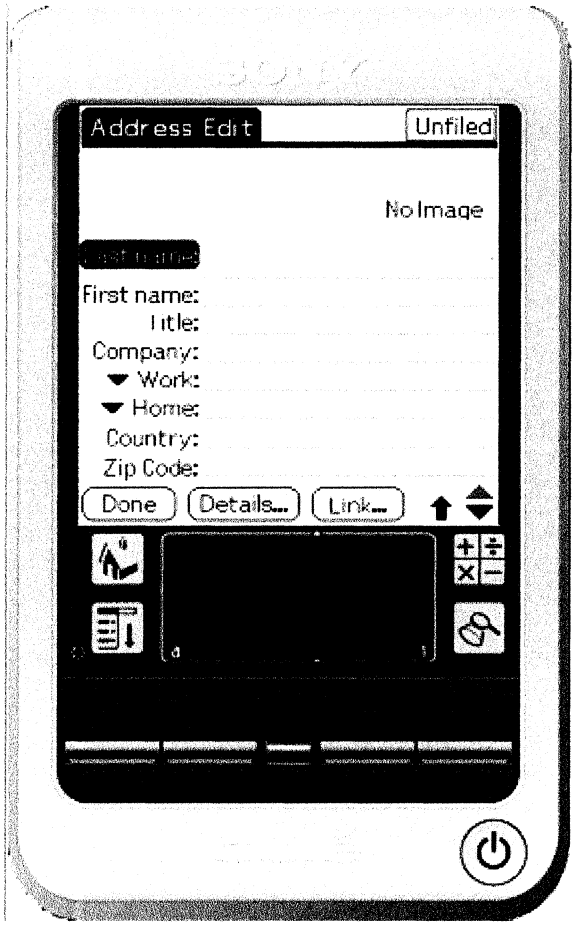

Figure 10. A new contact information screen (part 1)

The address input is in the Chinese way (Country first). If the user clicks on the down arrow, the screen will scroll down.

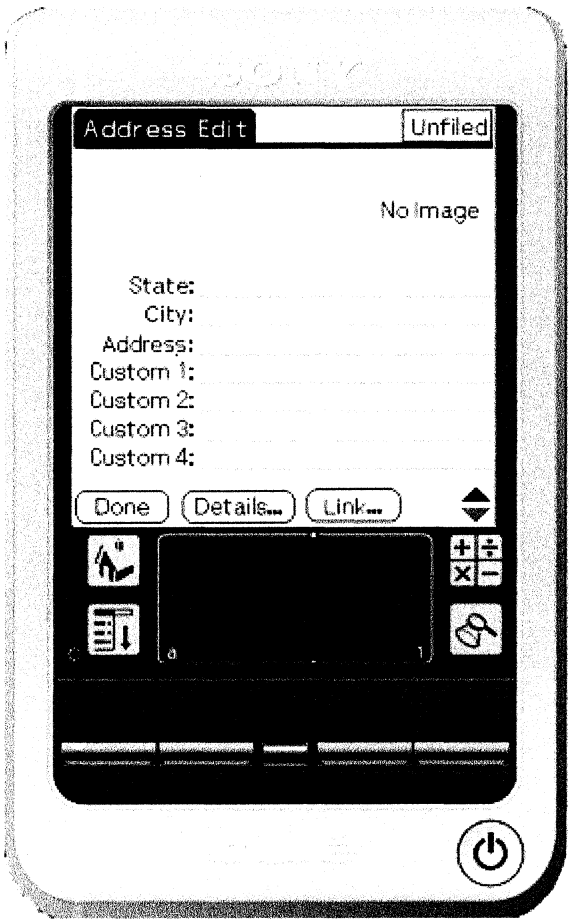

Figure 11. A new contact information screen (part 2)

The address input is in the Chinese way (Country first). If the user clicks on the down arrow, the screen will scroll down.

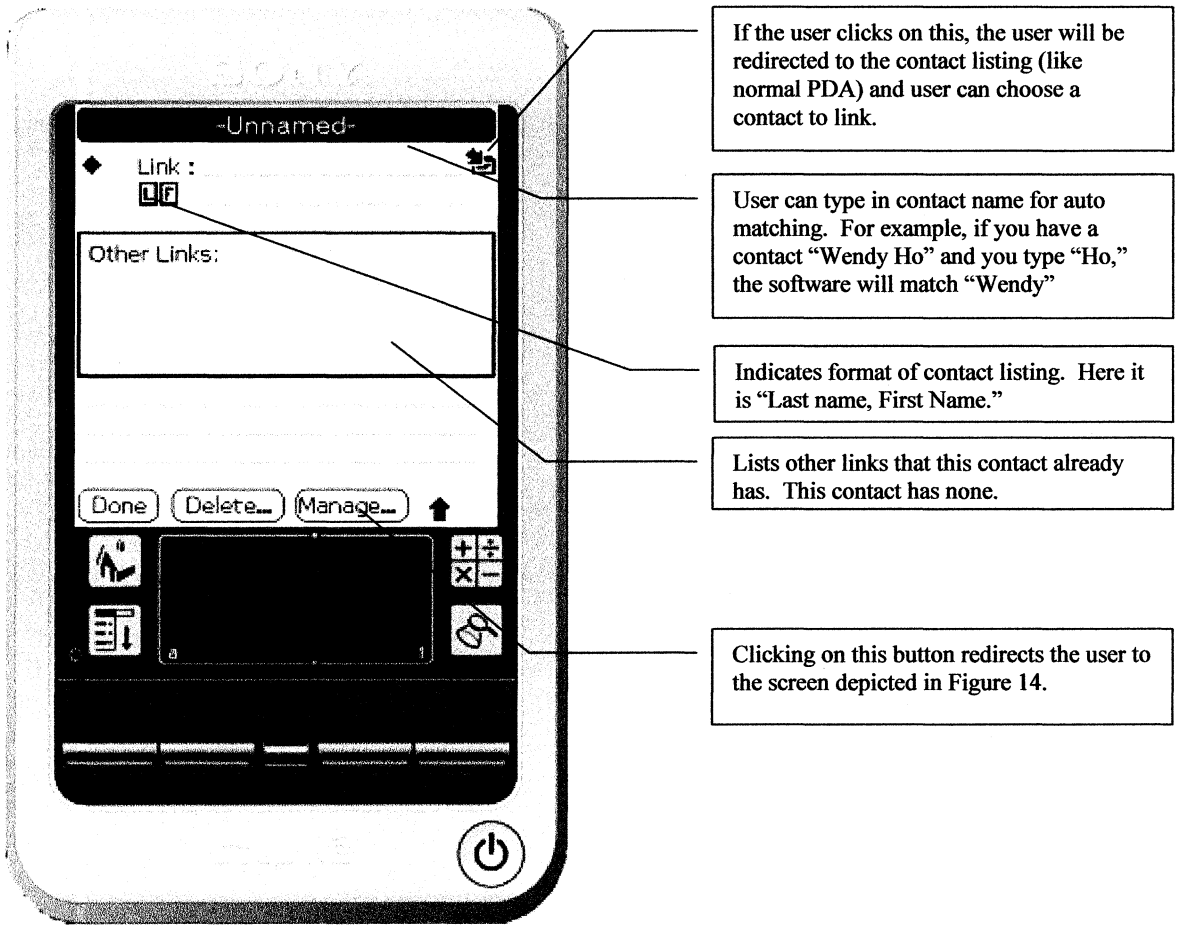

Figure 12. The Link screen within a Contact's information

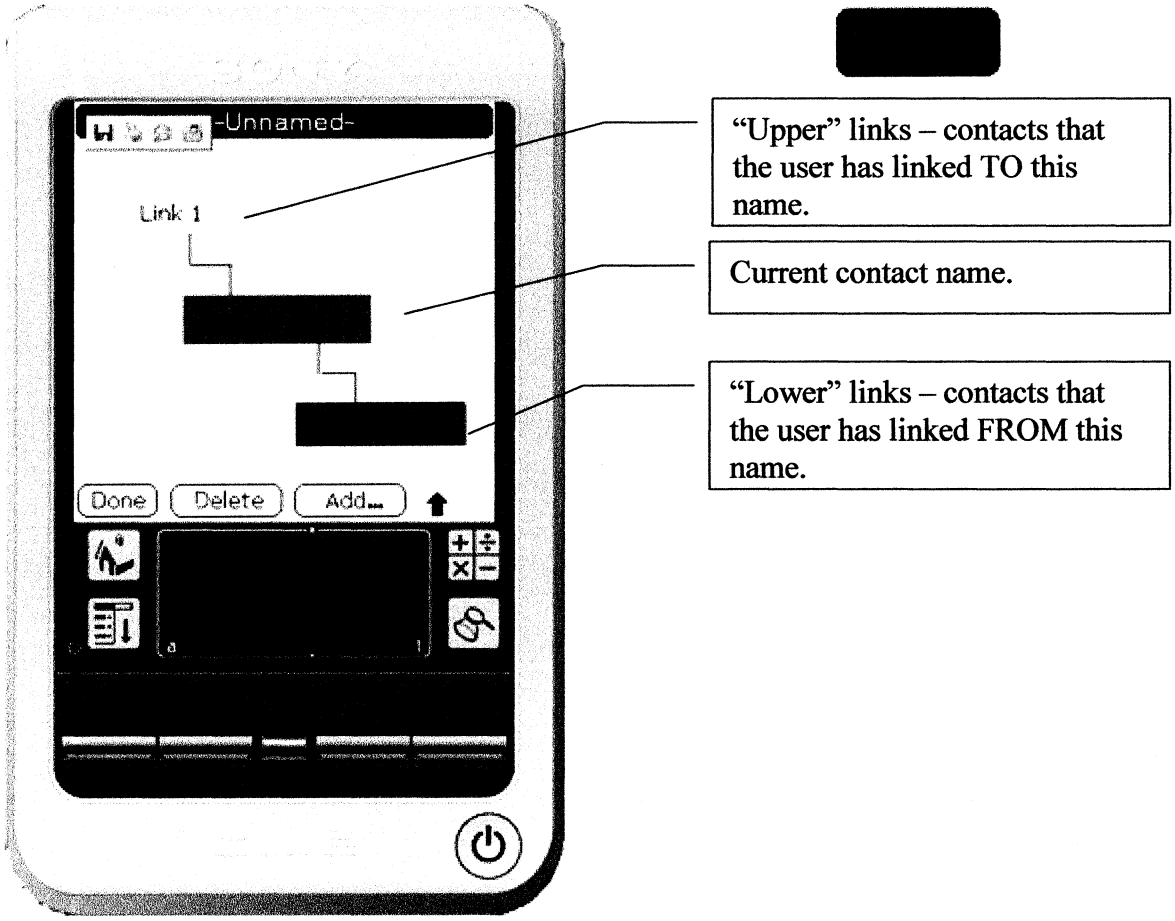

Figure 13. The Manage Links screen

The user gets here by clicking "Manage" from the screen in Figure 13. A contact does not have to have both upper (yellow) and lower (green) links. Links are displayed in a "web" format, with the current contact in the middle. Only one level up and down is shown.

APPENDIX K. BEHAVIORAL DATA

Below are the data observed from each participant while each participant was performing the tasks as listed in Appendix D. In the tables below, the following conventions are used:

- # - Participant number
- F – frustration
- H – hesitation
- C – confusion
- E – error
- PD – perceived difficulty (observer's subjective rating on how difficult the task was for the participant.)

Frustration, hesitation, confusion and error were noted if the experimenter felt that the participant displayed any of those behaviors. Perceived difficulty was rated on a scale of 1 through 5, with 1 being "no difficulty" and 5 being "extreme difficulty."

Table 24

Behavioral Data for Address Entry and Search Task by Participant (Non-Modified Interface)

	American Address Entry					Chinese Address Entry					Search Task				
#	F	H	C	E	PD	F	H	C	E	PD	F	H	C	E	PD
1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1.7
2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
3	0	0	0	0	1	0	0.5	0	0	1	0	0	0.3	0	2
4	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
5	0	0	0	0	1	0	0	0	0	1	0	0	0.3	0	2
6	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
7	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
8	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1

9	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1.3
10	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
11	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
12	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
13	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
14	0	0	0	0	1	0	0	0	0	1	0	0	0.3	0	2
15	0	0	0	0	1	0	0	0	0	1	0	0	0.3	0	2
16	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
17	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
18	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
19	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
20	0	0	0	0	1	0	0.5	0	0	1	0	0	0	0	1
21	0	0	0	0	1	0	0.5	0	0	1	0	0	0	0	1
22	0	0	0	0	1	0	0	0	0	1	0	0	0.3	0	2
23	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
24	0	0	0	0	1	0	0.5	0	0	1	0	0	0	0	1
25	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
26	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
27	0	0	0	0	1	0	0.5	0	0	1	0	0	0	0	1
28	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
29	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
30	0	0	0	0	1	0	0.5	0	0	1	0	0	0	0	1
31	0	0	0	0	1	0	0	0	0	1	0	0	0.3	0	2
32	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
33	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
34	0	0	0	0	1	0	0.5	0	0	1	0	0	0	0	1.3
35	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
36	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
37	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
38	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
39	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
40	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
Mean:	**0**	**0**	**0**	**0**	**1**	**0**	**0.1**	**0**	**0**	**1**	**0**	**0**	**0.1**	**0**	**1.2**
SD:	**0**	**0**	**0**	**0**	**0**	**0**	**0.2**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0**	**0.4**
Totals:	**0**	**0**	**0**	**0**	**40**	**0**	**3.5**	**0**	**0**	**40**	**0**	**0**	**2**	**0**	**47**

Table 25

Behavioral Data for Date Search Tasks by Participant (Non-Modified Interface)

	Finding Social Date	Finding Business Date

#	F	H	C	E	PD	F	H	C	E	PD
1	0	0	0	0	1	0	0	0	0	1
2	0	0	0	0	1	0	0	0	0	1
3	0	0	0	0	1	0	0	0	0	1
4	0	0	0	0	1	0	0	0	0	1
5	0	0	0	0	1	0	0	0	0	1
6	0	0	0	0	1	0	0	0	0	1
7	0	0	0	0	1	0	0	0	0	1
8	0	0	0	0	1	0	0	0	0	1
9	0	0	0	0	1	0	0	0	0	1
10	0	0	0	0	1	0	0	0	0	1
11	0	0	0	0	1	0	0	0	0	1
12	0	0	0	0	1	0	0	0	0	1
13	0	0	0	0	1	0	0	0	0	1
14	0	0	0	0	1	0	0	0	0	1
15	0	0	0	0	1	0	0	0	0	1
16	0	0	0	0	1	0	0	0	0	1
17	0	0	0	0	1	0	0	0	0	1
18	0	0	0	0	1	0	0	0	0	1
19	0	0	0	0	1	0	0	0	0	1
20	0	0	0	0	1	0	0	0	0	1
21	0	0	0	0	1	0	0	0	0	1
22	0	0	0	0	1	0	0	0	0	1
23	0	0	0	0	1	0	0	0	0	1
24	0	0	0	0	1	0	0	0	0	1
25	0	0	0	0	1	0	0	0	0	1
26	0	0	0	0	1	0	0	0	0	1
27	0	0	0	0	1	0	0	0	0	1
28	0	0	0	0	1	0	0	0	0	1
29	0	0	0	0	1	0	0	0	0	1
30	0	0	0	0	1	0	0	0	0	1
31	0	0	0	0	1	0	0	0	0	1
32	0	0	0	0	1	0	0	0	0	1
33	0	0	0	0	1	0	0	0	0	1
34	0	0	0	0	1	0	0	0	0	1
35	0	0	0	0	1	0	0	0	0	1
36	0	0	0	0	1	0	0	0	0	1
37	0	0	0	0	1	0	0	0	0	1
38	0	0	0	0	1	0	0	0	0	1
39	0	0	0	0	1	0	0	0	0	1
40	0	0	0	0	1	0	0	0	0	1
Mean:	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
SD:	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Totals:	**0**	**0**	**0**	**0**	**40**	**0**	**0**	**0**	**0**	**40**

Table 26

Behavioral Data for Address Entry and Search Task by Participant (Modified Interface)

	American Address Entry					Chinese Address Entry					Search Task				
#	F	H	C	E	PD	F	H	C	E	PD	F	H	C	E	PD
1	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
2	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
3	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
4	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
5	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
6	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
7	0	0	0	0	1	0	0.5	0.5	0	1	0	0.7	0	0	1.7
8	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
9	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
10	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
11	0	0	0	0	1	0	0.5	0.5	0	1	0	0.7	0	0	1
12	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
13	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.7
14	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
15	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
16	0	0	0	0	1	0	0.5	0.5	0	1	0	0.7	0	0	1
17	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
18	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
19	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
20	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
21	0	0	0	0	1	0	0.5	0.5	0	1	0	0.7	0	0	1
22	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
23	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
24	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
25	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
26	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
27	0	0	0	0	1	0	0.5	0.5	0	1	0	0.7	0	0	1.3
28	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1

29	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
30	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
31	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
32	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
33	0	0	0	0	1	0	0.5	0.5	0	1	0	0.7	0	0	1.3
34	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
35	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
36	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
37	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1.3
38	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
39	0	0	0	0	1	0	0.5	0.5	0	1	0	0.7	0	0	1.3
40	0	0	0	0	1	0	0.5	0.5	0	1	0	0.3	0	0	1
Mean:	**0**	**0**	**0**	**0**	**1**	**0**	**0.5**	**0.5**	**0**	**1**	**0**	**0.4**	**0**	**0**	**1.2**
SD:	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0**	**0**	**0.2**
Totals:	**0**	**0**	**0**	**0**	**40**	**0**	**20**	**20**	**0**	**40**	**0**	**16**	**0**	**0**	**46**

Table 27

Behavioral Data for Link Task by Participant (Modified Interface)

	Link Task (American)					Link Task (Chinese)				
#	**F**	**H**	**C**	**E**	**PD**	**F**	**H**	**C**	**E**	**PD**
1	0	0.7	0	0	1.7	0	0.5	0.5	0	1
2	0	0.7	0	0	1.7	0	0.5	0.5	0	1
3	0	0.7	0	0	1.7	0	0.5	0.5	0	1
4	0	0.7	0	0	1.7	0	0.5	0.5	0	1
5	0	0.7	0	0	1.7	0	0.5	0.5	0	1
6	0	0.7	0	0	1.7	0	0.5	0.5	0	1
7	0	0.7	0	0	1.7	0	0.5	0.5	0	1.5
8	0.7	0	0	0	2.3	0	0.5	0.5	0	1.5
9	0	0.7	0	0	1.7	0	0.5	0.5	0	1.5
10	0	0.7	0	0	1.7	0	0.5	0.5	0	2
11	0	0.7	0	0	1.7	0	0.5	0.5	0	2
12	0	0.7	0	0	1.7	0	0.5	0.5	0	1.5
13	0	0.7	0	0	2.3	0	0.5	0.5	0	1.5
14	0	1.3	0.7	0	1.7	0	0.5	0.5	0	1
15	0	0.7	0.7	0	1.7	0	0.5	0.5	0	1.5
16	0	0.7	0.7	0	1.7	0	0.5	0.5	0	1.5
17	0	0.7	0	0	1.7	0	0.5	0.5	0	1.5
18	0	0.7	0	0	1.7	0	0.5	0.5	0	1.5
19	0	0.7	0	0	1.7	0	0.5	0.5	0	1

20	0.7	1.3	1.3	0	1.7	0	0.5	0.5	0	1.5
21	0.7	0.7	0.7	0	1.7	0	0.5	0.5	0	1
22	0	0.7	0.7	0	1.7	0	0.5	0.5	0	1.5
23	0	0.7	0	0	1.7	0	0.5	0.5	0	1
24	0	0.7	0	0	2.3	0	0.5	0.5	0	2
25	0	0.7	0	0	1.7	0	0.5	0.5	0	1
26	0	0.7	0	0	1.7	0	0.5	0.5	0	1.5
27	0	0.7	0	0	2.3	0	0.5	0.5	0	1
28	0	0.7	0	0	1.7	0	0.5	0.5	0	1.5
29	0	0.7	0	0	2.3	0	0.5	0.5	0	1
30	0	0.7	0	0	1.7	0	0.5	0.5	0	1
31	0	0.7	0	0	1.7	0	0.5	0.5	0	1
32	0	0.7	0	0	1.7	0	0.5	0.5	0	1.5
33	0.7	0.7	0	0	1.7	0	0.5	0.5	0	1.5
34	0	0.7	0	0	1.7	0	0.5	0.5	0	2
35	0	0.7	0	0	1.7	0	0.5	0.5	0	2
36	0	0.7	0	0	1.7	0	0.5	0.5	0	1.5
37	0	0.7	0	0	1.7	0	0.5	0.5	0	1
38	0	0.7	0	0	1.7	0	0.5	0.5	0	1
39	0	0.7	0	0	1.7	0	0.5	0.5	0	1
40	0	0.7	0	0	1.7	0	0.5	0.5	0	1
Mean:	**0.1**	**0.7**	**0.1**	**0**	**1.8**	**0**	**0.5**	**0.5**	**0**	**1.3**
SD:	**0.2**	**0.2**	**0.3**	**0**	**0.2**	**0**	**0**	**0**	**0**	**0.3**
Totals:	**2.7**	**27**	**4.7**	**0**	**70**	**0**	**20**	**20**	**0**	**53**

Table 28

Behavioral Data for Date Search Tasks by Participant (Modified Interface)

	Finding Social Date					Finding Business Date				
#	**F**	**H**	**C**	**E**	**PD**	**F**	**H**	**C**	**E**	**PD**
1	0	0	0	0	1	0	0	0	0	1
2	0	0	0	0	1	0	1	0	0	1
3	0	0	0	0	1	0	0	0	0	1
4	0	0	0	0	1	0	1	0	0	1
5	0	0	0	0	1	0	0	0	0	1
6	0	0	0	0	1	0	0	0	0	1
7	0	0	0	0	1	0	0	0	0	1
8	0	0	0	0	1	0	1	0	0	1
9	0	0	0	0	1	0	0	0	0	1
10	0	1	0	0	1	0	1	0	0	1

11	0	1	0	0	1	0	1	0	0	1
12	0	0	0	0	1	0	0	0	0	1
13	0	1	0	0	1	0	1	0	0	1
14	0	1	0	0	1	0	1	0	0	1
15	0	0	0	0	1	0	0	0	0	1
16	0	1	0	0	1	0	1	0	0	1
17	0	0	0	0	1	0	1	0	0	1
18	0	0	0	0	1	0	0	0	0	1
19	0	0	0	0	1	0	0	0	0	1
20	0	0	0	0	1	0	0	0	0	1
21	0	1	0	0	1	0	1	0	0	1
22	0	1	0	0	1	0	0	0	0	1
23	0	0	0	0	1	0	0	0	0	1
24	0	1	0	0	1	0	1	0	0	1
25	0	1	0	0	1	0	1	0	0	1
26	0	1	0	0	1	0	1	0	0	1
27	0	1	0	0	1	0	1	0	0	1
28	0	1	0	0	1	0	1	0	0	1
29	0	1	0	0	1	0	1	0	0	1
30	0	1	0	0	1	0	1	0	0	1
31	0	1	0	0	1	0	0	0	0	1
32	0	1	0	0	1	0	1	0	0	1
33	0	0	0	0	1	0	0	0	0	1
34	0	1	0	0	1	0	1	0	0	1
35	0	0	0	0	1	0	0	0	0	1
36	0	0	0	0	1	0	0	0	0	1
37	0	1	0	0	1	0	1	0	0	1
38	0	0	0	0	1	0	0	0	0	1
39	0	0	0	0	1	0	0	0	0	1
40	0	1	0	0	1	0	1	0	0	1
Mean:	**0**	**0.5**	**0**	**0**	**1**	**0**	**0.5**	**0**	**0**	**1**
SD:	**0**	**0.5**	**0**	**0**	**0**	**0**	**0.5**	**0**	**0**	**0**
Totals:	**0**	**19**	**0**	**0**	**40**	**0**	**21**	**0**	**0**	**40**

APPENDIX L. IRB APPROVAL

San José State
UNIVERSITY

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Academic Vice President Graduate Studies and Research
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Voice: 408-283-7500
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To: Serena Gee
319 Monterey Blvd
San Francisco, CA 94131

From: Pam Stacks, Pam Stacks
Interim Academic Vice-President
Graduate Studies & Research

Date: July 3, 2003

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

"Product Culturization."

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to any and all data that may be collected from the subjects. The approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Pam Stacks immediately. Injury includes but is not limited to bodily harm, psychological trauma, and release of potentially damaging personal information. This approval for the human subjects portion of your project is in effect for one year, and data collection beyond July 3, 2004 requires an extension request.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services that the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2480.

cc: Dr Kevin Corker

The California State University:
Chancellor's Office
Bakersfield, Channel Islands, Chico, Dominguez Hills, Fresno, Fullerton, Hayward, Humboldt, Long Beach, Los Angeles, Maritime Academy, Monterey Bay, Northridge, Pomona, Sacramento, San Bernardino, San Diego, San Francisco, San José, San Luis Obispo, San Marcos, Sonoma, Stanislaus